User Manual

SG10KTL/SG12KTL/
SG15KTL/SG20KTL
PV Grid-Connected Inverter

SG10_12_15_20KTLV41-UEN-Ver30-201412 Version: 3.0

About This Manual

This manual is for the inverters SG10KTL, SG12KTL, SG15KTL and SG20KTL. These inverters are grid-connected, transformer-less, robust and of high conversion efficiency. The device will bring you profit from PV power system.

Aim

The manual contains information about the inverter, which will provide you guidelines to connect the inverter into the PV power system and how to operate the inverter.

Related Documents

The manual cannot include complete information about the PV system. You will get the additional information about other devices at www.sungrowpower.com or via webpage of device manufacturer.

Target Group

The manual is targeted to technical personnel who is responsible for inverter installation and commissioning in the PV power system and inverter owner who will perform daily LCD operation.

How to Use This Manual

Read the manual and other related documents before any work with the inverter. Documents must be stored carefully and available at all times.

The contents of the manual will be periodically updated or revised due to product development. It is probably that there are changes of manual in subsequent inverter edition. The latest manual can be acquired via visiting the web page www.sungrowpower.com.

Symbols Explanation

Important instructions contained in this manual should be followed during installation, operation and maintenance of the inverter. And they will be highlighted by the following symbols.

⚠ DANGER

DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which, if not avoided, could result in equipment or property damage.

NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.

Symbols on the Inverter Body

	This symbol indicates that you should wait at least 10 minutes after disconnecting the inverter from the utility grid and from the PV input before touching any inner live parts.
	Hot surface! In order to reduce the risk of burns, do not touch the hot surface when the device is running.
	Look over the user manual before any operation on the inverter!
	The installation and service of the inverter unit can only be performed by qualified personnel.
	Do not disconnect DC connectors from the unit under load!

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1 Safety Instructions

IMPORTANT SAFETY INSTRUCTIONS

The SG10KTL, SG12KTL, SG15KTL and SG20KTL have been designed and tested strictly according to the international safety regulations. As electrical and electronic equipment, safety instructions related to them must be complied with during installation, commissioning, operation and maintenance. Incorrect operation or work may result in damage to:

- The life and well-being of the operator or a third party
- The inverter and other properties that belong to the operator or a third party

Therefore, the following general safety instructions must be read and always kept in mind prior to any work. All detailed work-related safety warnings and notes will be specified at the critical points in corresponding chapter.

⚠ WARNING

All installation and electrical work must only be performed by qualified personnel. They have

- **been trained specially;**
- **already completely read through and understood the manual and other related documents;**
- **been familiar with safety requirements for electrical system.**

Technical personnel mentioned above may perform the following work:

- Install the inverter onto the wall
- Connect the inverter into the PV power system
- Connect other devices into the PV power system
- Commission the inverter
- Maintain and service the inverter

Before Installation

⚠ CAUTION

There is a risk of injury due to improperly handling the device!

- **Always follow the instructions contained in the manual when moving and positioning the inverter.**
- **The weight of the equipment can cause injuries, serious wounds, or bruise if improperly handled.**

NOTICE

The unit is thoroughly tested and strictly inspected before delivery. Damage may still occur during shipping.

If there is visible damage to the packaging or the inner contents, or if there is something missing, contact the unit dealer.

During Installation

⚠ DANGER

Prior to installing the inverter onto the wall, it is crucial to make certain that the inverter is not electrically connected.

⚠ CAUTION

System performance loss due to bad ventilation!

The equipment requires good quality ventilation during operation. It is essential to keep the unit upright and nothing covering the heat sink to ensure that the equipment interior is well cooled down.

During Electrical Connection

NOTICE

All electrical connections must be in accordance with local and national standards.

Only with the permission of the local energy sector, the inverter can be connected into the utility grid.

DANGER

Lethal voltage exists!

PV arrays will produce electrical energy when exposed to sunlight and thus can create an electrical shock hazard.

- **Wiring of the PV arrays should only be performed by qualified personnel.**

WARNING

All cables must be firmly attached, undamaged, properly insulated and adequately dimensioned.

During Inverter Operation

Do not open the enclosure when the inverter is under voltage. There is a highly unlikely risk of explosion in very specific cases of malfunction. The housing will protect persons and property from such an explosion, only if it is correctly sealed.

DANGER

There is a risk of inverter damage or personal injury!

Do not disconnect DC connectors while the inverter is under AC load! First de-energize the equipment from dual power sources and then verify that there is no voltage present.

CAUTION

There is a risk of burn!

Prevent from touching device hot parts (such as heat sink) during operation. Only LCD display panel and DC switch can be touched during inverter operation.

Maintenance and Service

DANGER

There is a risk of inverter damage or personnel injury due to incorrect service work!

Always keep in mind that the inverter is power supplied by dual power source: PV arrays and utility grid.

Before any service work, you should obey the following procedures.

- **Disconnect inverter from the utility grid side first and then PV arrays;**
- **Wait at least ten minutes until the inner capacitors discharge completely;**
- **Verify that no voltage and current present with appropriate testing device.**

CAUTION

Keep unrelated person away!

A temporary warning sign and barrier must be posted to keep non-related person away for any period while performing electrical connection and service work.

NOTICE

- **Any malfunction that may impair the inverter safety functions must be repaired immediately before the inverter is restarted again.**
- **Inverter contains no owner serviceable parts inside. Please contact local authorized personnel if any service work is required.**

Servicing of the device in accordance with the manual should never be undertaken in the absence of proper tools, test equipment or more recent revision of the manual which is clearly and thoroughly understood.

NOTICE

There is a risk of inverter damage if it is improperly serviced.

Use only accessories and spare parts approved by the inverter manufacturer. Never modify the inverter or other components of the inverter. Otherwise it will cause loss of any or all warranty rights.

NOTICE

There is a risk of inverter damage due to electrostatic discharge!

The printed circuit boards contain components sensitive to electrostatic discharge. Wear a grounding wrist band when handling the boards. Avoid unnecessary touch with the boards during replacement.

Others

NOTICE

The selected country settings can be changed by service personnel only!

Unauthorized alternation of the country settings should be prohibited. Otherwise it may cause a breach of the type-certificate marking.

WARNING

All safety instructions, warning labels and nameplate on the inverter body:

- **Must be clearly visible;**
- **Must not be removed, covered or pasted.**

WARNING

These regulations should also be followed:

- **The regulations related to the electricity fed into grid;**
- **The safety instructions related to PV arrays;**
- **The safety instructions related to other electrical device.**

2 Product Introduction

2.1 Intended Usage

SG10KTL, SG12KTL, SG15KTL and SG20KTL (They will be referred to as inverter hereinafter unless otherwise specified), which are 3-phase string inverters without transformer, are crucial units between the PV strings and utility grid in the small-scaled PV power system.

Inverter is dedicated to converting direct current power generated by the PV modules into alternating current, which conforms to parameters of local utility grid, and feeds the alternating current into the utility grid. The intended usage of the inverter is illustrated in Fig. 2-1.

WARNING

Inverter CANNOT be connected to the PV modules, the positive or negative terminal of which needs to be grounded.

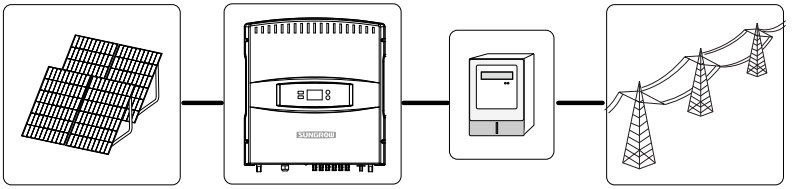


Fig. 2-1 Application of the inverter of the PV Power System

Item	Description	Note
A	PV strings	monocrystalline silicon; polycrystalline silicon and thin-film without grounding
B	Inverter	SG10KTL, SG12KTL ,SG15KTL or SG20KTL involved
C	Metering device	meter cupboard with power distribution system
D	Utility grid	TT, TN-C, TN-S, TN-C-S

NOTICE

Any other or additional usage is not permitted except the intended usage.

Inverter may only accept PV modules with Protection Class II as its input.

Inverter may only be connected to utility grid via distribution board. Local loads (home appliance, lights, motor loads, etc.) cannot be connected between inverter and AC circuit breaker on the distribution board.

Additionally, the unit is intended for fixed installation. Located on a part that is not removable without impairing the operation of the unit.

2.2 Product Description

2.2.1 Product Appearance

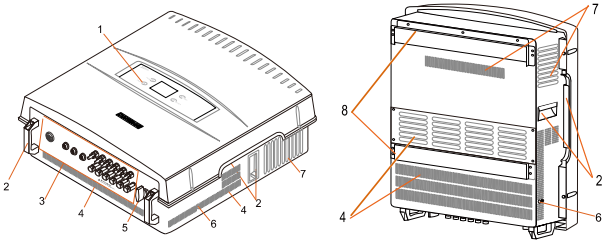


Fig. 2-2 Product Components Description

Item	Name	Description
1	LCD display panel	Inverter operation data viewing and parameters configuration can be performed via the LCD display panel.
2	Handles	The handles are designed for holding the unit when transporting, installing or servicing.
3	Connection terminals	They are DC input terminals, AC output terminal and RS485 communication terminal.
4	Air inlet	Entrance of cool air.
5	DC switch	During normal operation it is in "ON" state. It can shut down the inverter immediately in "OFF" position.
6	Second PE terminals	Second protective earth terminals as specified in EN 50178.
7	Air outlet	Exit of hot air during the inverter operation.
8	Mounting ear	It is used for hanging inverter onto the backplate.

2.2.2 Dimensions and Weight of Inverter

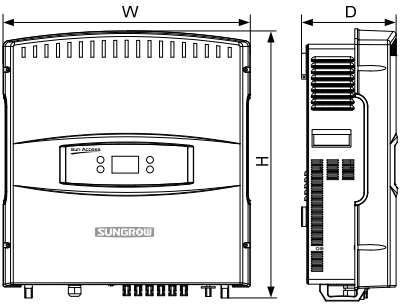


Fig. 2-3 Outline Dimensions of Inverter

Type	W(mm)	H(mm)	D(mm)	Net weight(kg)
SG10KTL/SG12KTL/SG15KTL	648	686	246	50
SG20KTL	648	686	246	55

2.2.3 LCD Display Panel

As a human-computer interaction interface, LCD display panel comprises LED indicators, buttons and LCD display screen on the front panel of the inverter

- LEDs indicate the working status of the inverter
- The current running information shown on the LCD display
- Malfunction records shown on the LCD display
- Inverter configuration by pressing the buttons

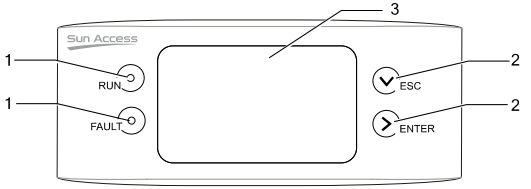


Fig. 2-4 LCD Display Panel

No.	Name	Description
1	LED indicators	"RUN" and "FAULT". Inverter current state can be known from the two indicators. Detailed definition is shown in Tab. 2-1.
2	Buttons	Navigate in the LCD menu, select values and so on. Detailed function is shown in Tab. 10-1.
3	LCD screen	LCD screen can display current state of inverter, current running information, history information and parameters to be set.

Tab. 2-1 Description of LED Indicator

LED State	Description
"RUN": on "FAULT": off	Inverter is feeding AC power to the utility grid.
"RUN": off "FAULT": on	A malfunction happens; or protection function triggers.
"RUN": off "FAULT": off	Inverter is not energized; There is a communication error between DSP and LCD.

2.2.4 DC Switch

DC switch is designed for safely disconnecting the DC current if required.

The inverter works automatically when input and output meet the requirements. If you want to interrupt its running or if a malfunction occurs, rotate DC switch to the "OFF" position to stop inverter from running.

Rotate the DC switch to the "ON" position, before restarting the inverter.

2.3 Technical Description

2.3.1 Principle Description

The principle design of transformer-less and grid-connected inverter is illustrated in Fig. 2-5.

Six PV strings input voltage is transmitted to DC BUS via Boost circuit. SG10/12/15/20KTL inverters are equipped with MPPTs for two DC inputs to ensure that the maximum power can be utilized even in different PV installation conditions. Three-level inverter circuit converts the DC power into AC power, which will be fed into the utility grid via five core terminals. Protective circuits are designed to guarantee inverter safe operation and human safety.

A DC switch is integrated for safe disconnection of DC current. The inverter provides standard interface RS485 for communication. Inverters are also provided running records display and parameters configuration via human-computer interface –LCD display panel.

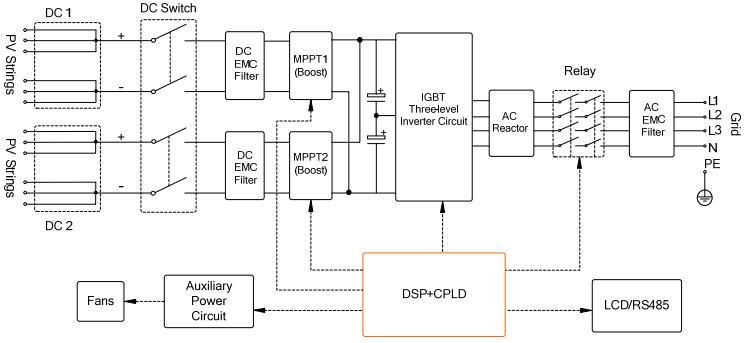


Fig. 2-5 Main Circuit Diagram of Inverter

2.3.2 Functions Description

Inverter functions can be grouped as the following:

- Conversion function

  Inverter converts the direct current power into alternating current power, which conforms to the grid requirement of its installation country.

- Data storage and display

  Inverter stores essential data including running information and fault records, and displays them on integrated LCD display.

- Parameters configuration

  Inverter provides various parameters configuration for optimal operation.

- Communication interface

  Standard RS485 interface for connecting other monitoring devices into the PV system is included.

- Protection functions include
  - Short circuit protection
  - Insulation resistance to ground surveillance
  - Inverter output voltage surveillance
  - Inverter output frequency surveillance
  - Residual current protection
  - DC component of AC output current surveillance
  - Anti-islanding phenomena protection
  - Ambient temperature surveillance
  - DC over-voltage protection
  - Over current protection
  - Power module over-temperature protection

2.3.3 Derating

Derating the output power is a way to protect the inverter from overload and potential malfunctions. Inverter's derating function can be activated in the following scenarios:

- PV input overload
- Too low grid voltage
- Too high inner temperature
- Power limit setting on the inverter LCD display
- Grid frequency too high (when the Country selection is "DE" or "IT")

PV Overload Derating

When the PV input power exceeds the defined *TotalInputPowerMax, see Tab. 2-2*, the inverter will reduce the power evenly to the maximum limit and keep the output power at nominal value.

Tab. 2-2 Maximum Input Power

Type	SG10KTL	SG12KTL	SG15KTL	SG20KTL
TotalInputPowerMax	11000W	13000W	15800W	21000W

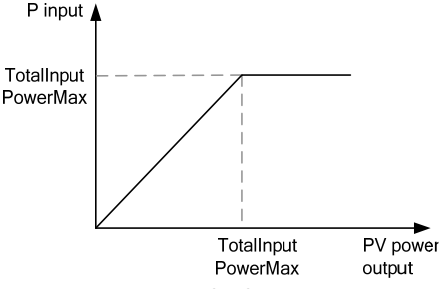


Fig. 2-6 PV Overload Derating

Grid Under-voltage Derating

Once the grid voltage is in the defined range of Vgrid (Vmin…215V), the inverter will decrease the power output.

$$P_{[Vmin...215V]} = Pn \times (Vgrid / 230V)$$

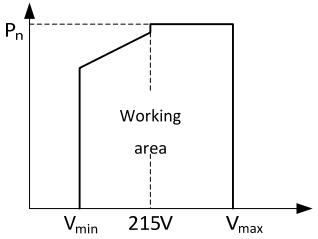


Fig. 2-7 Grid Under-voltage Derating

Over-temperature Derating

Power modules over-temperature may result from high ambient temperature, poor ventilation or fault of fans. Over-temperature derating may protect the inverter as well as the power modules against damage.

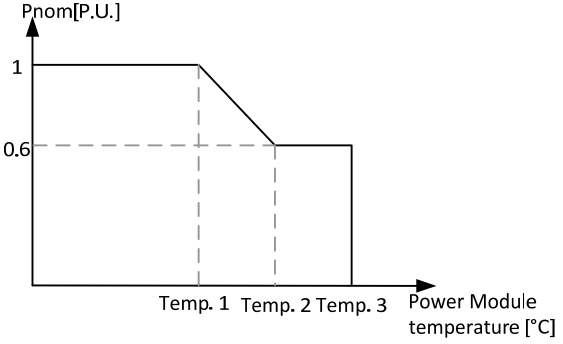


Fig. 2-8 Over-temperature Derating

Power Limit Setting

User may allocate output power value of the inverter via LCD control panel; refer to ***10.10 Running Parameter Setting***.

3 Installation Flow

Fig. 3-1 shows the installation flow of inverter for installer. Please follow these procedures.

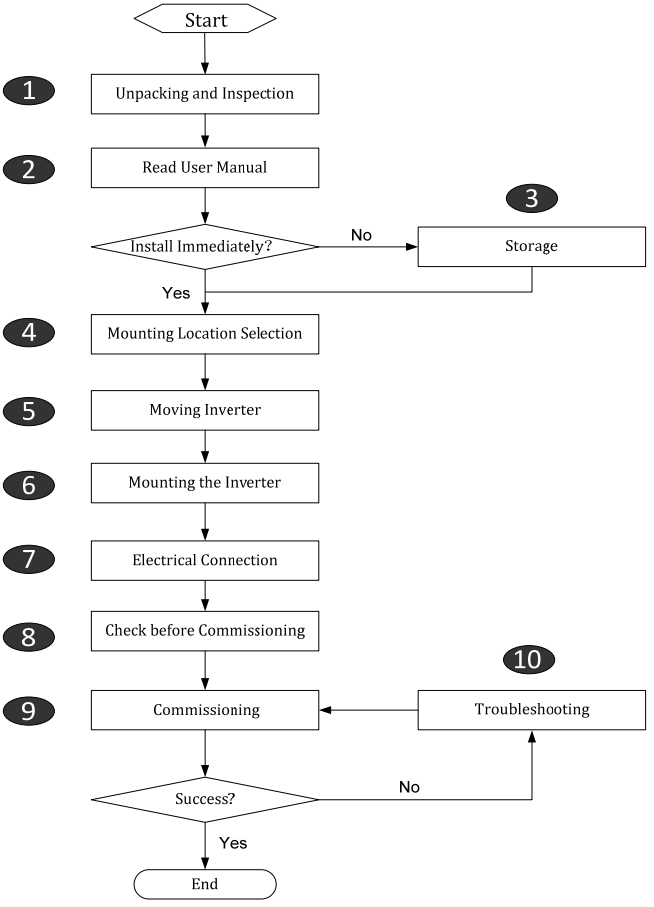


Fig. 3-1 Installation Flow Chart

Tab. 3-1 Description of Installation Flow

Order	Description	Reference Chapter
1	Unpacking and inspection	Section 4.1
2	Read this manual, especially the section on "safety instruction"	Chapter 1
3	Store the inverter unit if not install immediately	Section 4.4
4	Choose the best installation site	Section 5.1
5	Moving the inverter to installation site	Section 5.2
6	Install the inverter against the chosen wall	Section 5.3
7	Electrical connections include DC, AC, ground and communication(optional)connection	Section 6.3...6.6
8	Examine before commissioning	Section 7.1
9	Start up inverter and configure corresponding parameters	Section 7.2
10	Troubleshooting	Section 9.1

4 Unpacking and Storage

4.1 Unpacking and Inspection

The unit is thoroughly tested and strictly inspected before delivery. Damage may still occur during shipping.

- Check the packing for any visible damage upon receiving.
- Check the inner contents for damage after unpacking.
- Check the completeness of delivery contents according to the inner packing list.

If there is visible damage to the packaging or the inner contents, or if there is something missing, contact the unit dealer.

Do not dispose of the original packaging. It will be the best choice to store the inverter by re-using the original packaging.

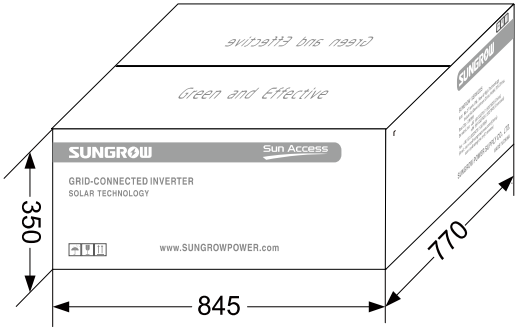


Fig. 4-1 Single Inverter in Original Packaging Carton(unit: mm)

4.2 Identifying Inverter

A nameplate is attached to one side of the inverter and the carton respectively. It provides information on type of inverter, along with the most important specifications, marks of certification institutions, website and serial number which is available and identified by Sungrow.

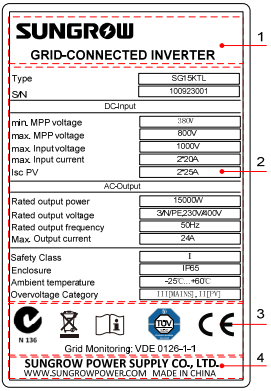


Fig. 4-2 Nameplate of Inverter

*Image shown here is indicative only. Actual product you receive may differ.

Item	Description
1	SUNGROW logo and product type
2	Technical data of inverter
3	Marks of certification institutions of inverter
4	Company name, website and origin

Tab. 4-1 Description of Icons on the Nameplate

Icon	Description
	C-tick mark of conformity. The inverter is in compliance with directives of c-tick.
	Don't dispose of the inverter with the household waste.
	Refer to the corresponding instructions.
	TUV mark of conformity. The inverter is in compliance with directives of TUV.
	CE mark of conformity. The inverter is in compliance with directives of CE.

4.3 Delivery Contents

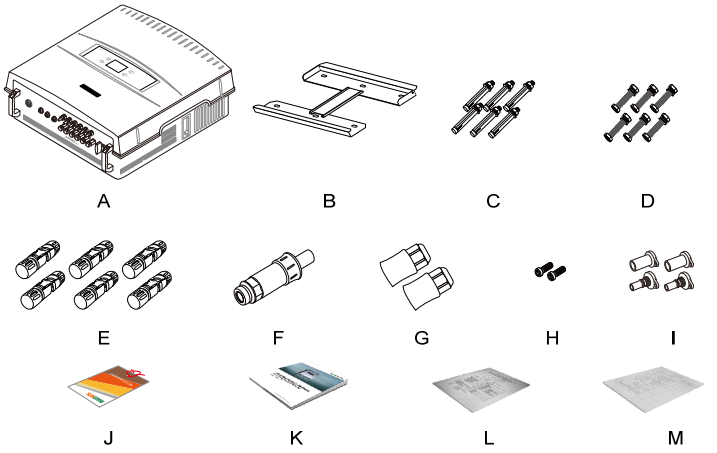


Fig. 4-3 Delivery Contents

Item	Description
A	Inverter unit
B	Backplate for mounting inverter onto the wall
C	Expansion bolts for fastening backplate onto concrete wall
D	Fastener set for installing backplate on metal frame
E	PV input connectors, including positive and negative connectors
F	AC connector
G	Waterproof communication connector
H	2 M4×16 screws for fix the inverter to the backplate.
I	Two pairs. Seal the unplugged PV connectors with sealing caps.
J	Quality certificate
K	User Manual and Quick Installation Guide
L	Packing list
M	Product test report

4.4 Storage of Inverter

Where the inverter may not be installed immediately or inverter needs to be stored under certain condition, store the unit as the following indications:

- The unit must be packed into original carton and desiccant must be put inside. If the original packaging is not available, an equivalent carton which is able to support the unit weight and size can be used.
- The packing should be sealed by adhesive tape.
- The unit must be stored in a clean and dry place to protect against dust and moisture.
- The storage temperature should be always between -30°C and 85°C. And the storage relative humidity should be always between 0 and 100%.
- It is very important to keep the packing away from chemicals. Otherwise it will lead to corrosion.
- During the storage time, periodically check any visible damage by rats and other rodents. Replace the packaging if necessary.
- The packaging should be kept upright.
- If there is more than one inverter to be stored, the maximum layers for original carton is three.
- After long term storage, local installer or service dept. of Sungrow should perform a comprehensive test before connecting the inverter into PV power system.

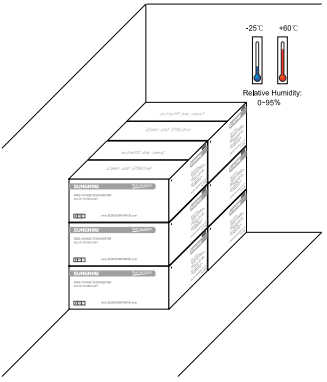


Fig. 4-4 Example for Inverter Storage

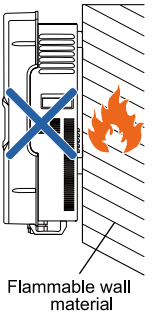
5 Installing Inverter onto Wall

Installation shall comply with local regulations and technical rules. Installation shall comply with the relevant instructions of AS 4777.1.

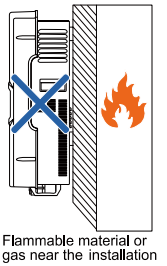
5.1 Selecting Installation Location

Selecting an optimal installation location for the inverter is decisive for its operating safety as well as its expected efficiency and service life.

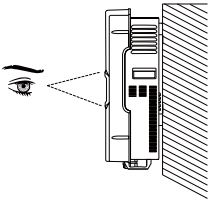
- Take the load capacity of the wall into account. The wall (such as concrete wall and metal structure) should be strong enough to hold the weight of the inverter over a long period of time.
- Install the unit where is accessible to install, electrical connect or service.
- Do not install the unit on the wall of flammable materials.



- Do not install the inverter where contains flammable materials or flammable gas in the vicinity of the unit installation.

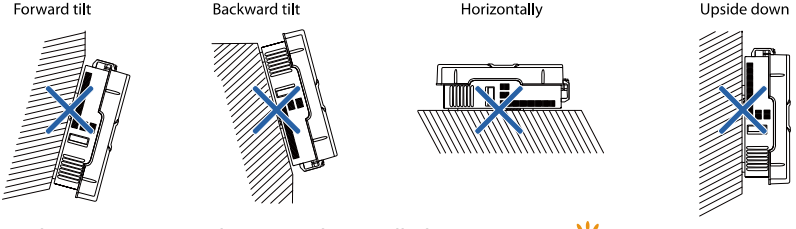


- Install the unit at eye level for easily buttons operation and display read.

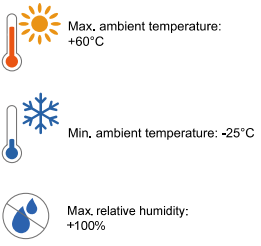


- It is suggested that the inverter be installed vertically with upside up for good heat dissipation.

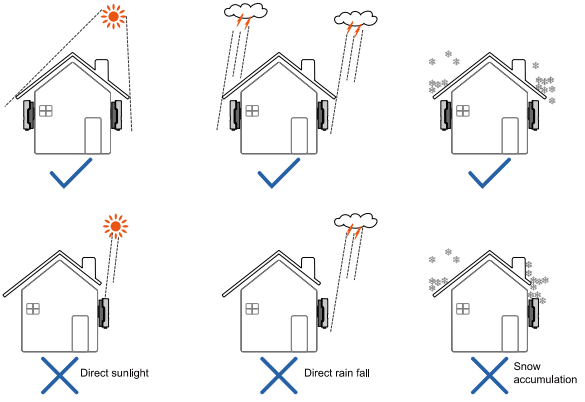
- Never install the inverter horizontally, nor with a forward tilt nor with a backward tilt nor even with upside down.



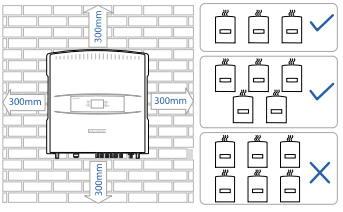
- The inverter unit with IP65 can be installed indoors or outdoors also.
- The ambient temperature should range from -25°C to 60°C.
- The relative humidity at the installation can reach 100%. Moisture may result in corrosion and damage to the internal device components.



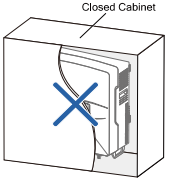
- Avoid exposing inverter to direct sunlight or rain or snow to extend its service life despite the IP65 protection degree. Exposure to the sun may cause additional internal heating which will cause power reducing. Shaded site of the building is preferred.



- Take enough space for convection into consideration during installing the inverter.
- For multiple inverters installation, position the inverters side by side. For multi-row inverters installation, position the inverters in a staggered arrangement.



- Do not install the inverter in a closed cabinet. Otherwise, the inverter will not operate normally.



- Do not install the inverter where children can reach.

- Do not install the inverter in living area. Noise may be produced during inverter running, which may affect your daily life.

5.2 Moving Inverter to Installation Site

If the inverter is to be installed, remove the unit from the packaging and move it to the selected installation site. During the moving process, the following instructions should be obeyed.

1. Always remember the weight of the inverters.
2. Grasp the equipment handles by both hands by means of handles.
3. Move the unit with the help of others or the lifting device.
4. Do not release the equipment unless it has been secured to the wall firmly.

5.3 Mounting the Inverter

Inverter is installed onto the wall by means of backplate enclosed in the packaging.

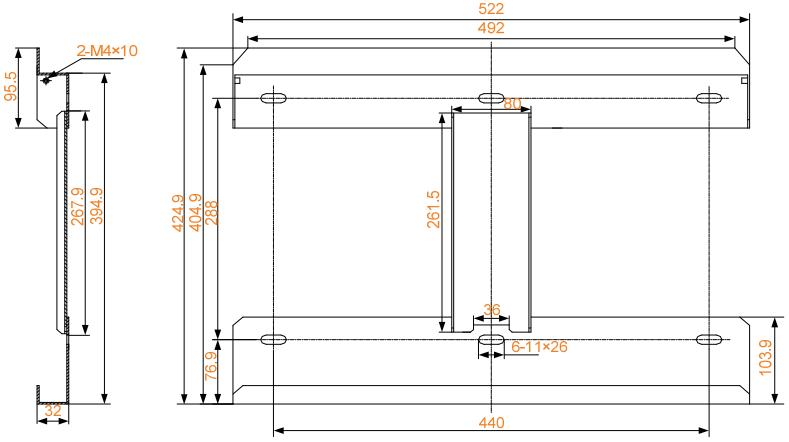


Fig. 5-1 Dimensions of Backplate(unit: mm)

There are two sets of stainless fasteners supplied to attach the backplate to concrete wall and metal frame.

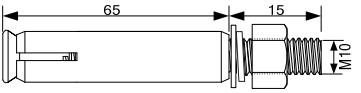


Fig. 5-2 Dimensions of Expansion Bolt Set for Concrete Wall (unit: mm)

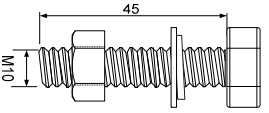


Fig. 5-3 Dimensions of Fastener Set for Metal Frame(unit: mm)

5.3.1 Installing the Inverter on Concrete Wall

Step 1 Remove backplate and fasteners from the packaging.

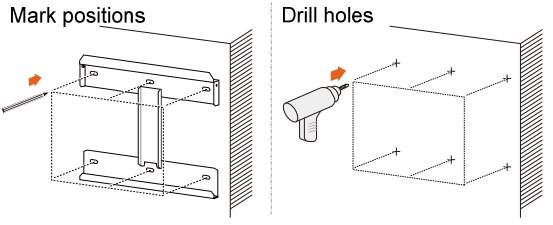
Step 2 Place the backplate onto the chosen concrete wall and adjust it until it is in a horizontal position.

Step 3 Mark the positions to drill holes using the backplate as the template.

Step 4 Drill holes according to the marks made before.

DANGER

In order to avoid electrical shock or other injury, inspect existing electronic or plumbing installations before drilling holes.



Step 5 Attach the backplate to the wall firmly with the supplied expansion bolt set. The torque for fastening the nut is 35 N·m.

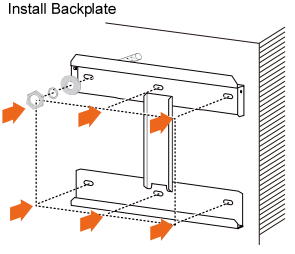


Fig. 5-4 Fasten the Backplate against Concrete Wall with M10*80 Expansion Bolt Set

Step 6 Lift up the inverter above the backplate with the help of others and then slide down, making sure that the two mounting ears on the back of the inverter and counterparts of the backplate engage perfectly, as shown in Fig. 5-5.

Step 7 After fit the inverter to the backplate, fasten the inverter to the backplate with two M4×16 screws.

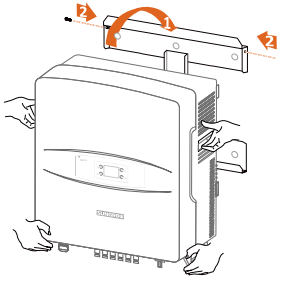


Fig. 5-5 Installing the Inverter

5.3.2 Installing the Inverter on Metal Frame

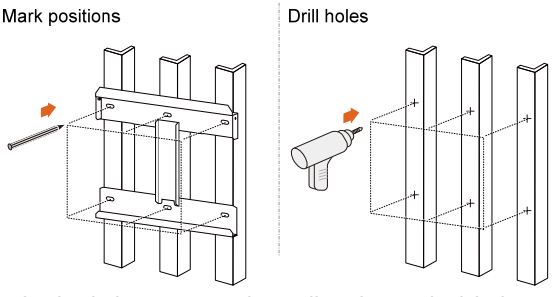
If the chosen mounting location is metal frame, please follow steps below to mount the inverter.

Step 1 Remove the backplate from the packaging.

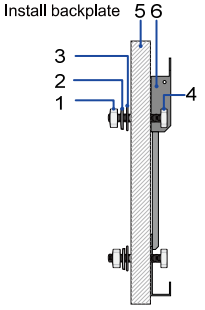
Step 2 Place the backplate onto the chosen metal frame and adjust it until it is in a horizontal position.

Step 3 Mark the positions to drill holes using the backplate as the template.

Step 4 Drill holes according to the marks you have made.



Step 5 Fasten the backplate against the wall with supplied bolts and nuts. The torque for fastening the nut is 35 N·m.



No.	Description	Remark
1	Hexagonal socket nut	M10
2	Spring washer	------
3	Washer	------
4	Hexagonal bolt	M10*45
5	Metallic wall	------
6	Backplate	------

Fig. 5-6 Fasten Backplate against Metal Frame with Bolts and Nuts

Step 6 Lift up the inverter above the backplate with the help of others and then slide down to make sure that the two mounting ears on the back of the inverter fit perfectly with the backplate, as shown in Fig. 5-7.

Step 7 After fit the inverter to the backplate, fasten the inverter to the backplate with two M4×16 screws.

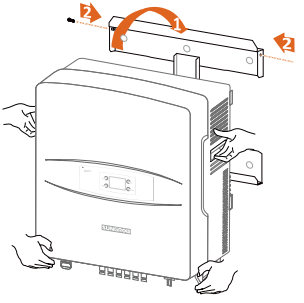


Fig. 5-7 Attaching Inverter onto Backplate

6 Electrical Connection

Once the inverter is firmly attached to the appropriate location, it can be connected to the PV power system.

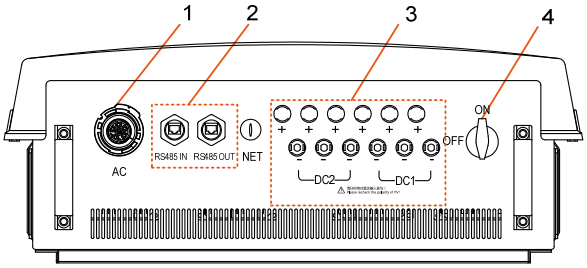
WARNING

Improper operation during the wiring process can cause fatal injury to the operator or unrecoverable damage to the inverter. Only qualified personnel can perform the wiring work.

Prior to any electrical connection, keep in mind that inverter has dual power supplies. It is mandatory for technical personnel to wear personal protective equipments: helmet, footwear and gloves during the electrical work.

6.1 Terminals Description

All electrical terminals are shown in Fig. 6-1. Sungrow provides corresponding plug connectors in the scope of delivery, as a result of convenient and safe connection without opening the lid.



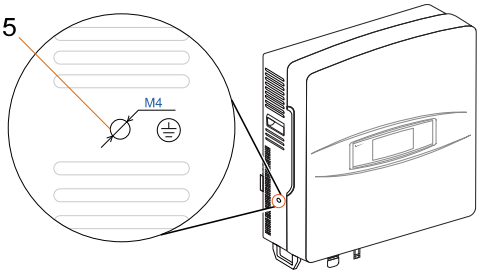


Fig. 6-1 Terminals Description

Item	Description
1	AC: AC terminals SG10KTL/SG12KTL/SG15KTL: Amphenol C16_L; SG20KTL: Wieland RST50I5
2	RS485 IN / RS485 OUT: RS485communication terminals, RJ45
3	DC1/DC2: DC terminals, MC4 PV-KST4/6II-UR, PV-KBT4/6II-UR
4	Integrated DC switch
5	Second Protective Earth Terminals

6.2 Simplified Electrical Connection Diagram

Connecting inverter to the existing PV system includes connecting inverter to local grid and connecting inverter to PV arrays. There may be communication connection for monitoring inverter operation if necessary.

All electrical connection should follow the National Wiring Rules of Standard AS/NZS 3000. The requirements in AS 4777.1 and AS/NZS 3000 indicate that a DC isolator must be used before the inverter.

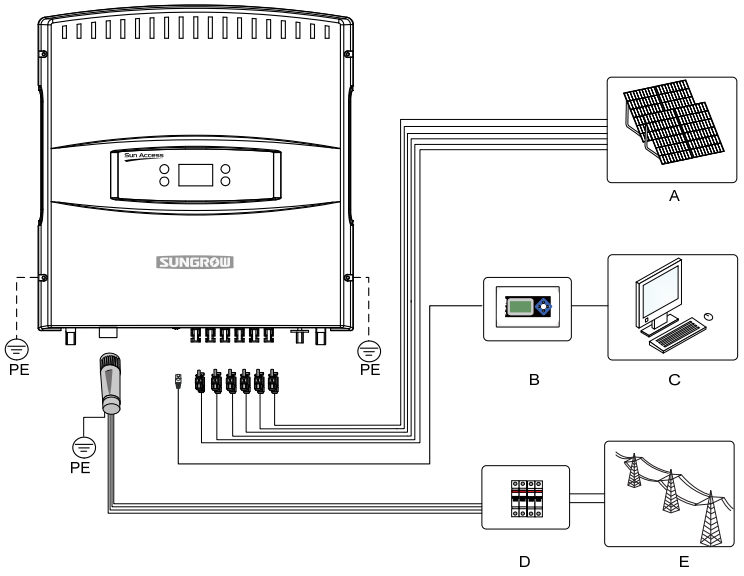


Fig. 6-2 Electrical Connection Diagram

Item	Description	Remark
A	PV arrays	The maximum open-circuit voltage of each PV string is 1000V.
B	SolarInfo Logger	It can be ordered from Sungrow.
C	PC	User equips this device to monitor inverter.
D	AC circuit breaker	Used as a protective device during electrical connection. User equips this device according to the maximum output voltage and current.
E	Utility Grid	Rated AC voltage is 230V.

6.3 Connecting Inverter to AC Grid

6.3.1 AC Side Requirements

Only after receiving prior approval from the local grid company as required, should you connect the inverter to the grid.

AC Side Circuit Breaker

An independent three or four-pole circuit breaker for each inverter must be installed at the output side to ensure that the inverter can be securely disconnected.

Inverter Type	Specification Recommended of AC Circuit Breaker
SG10KTL	20A
SG12KTL	25A
SG15KTL	32A
SG20KTL	40A

NOTICE

There are some points that are not allowed for the inverter:

- **It is not allowed for several inverters to use the same circuit breaker.**
- **It is not allowed to connect loads between inverter and circuit breaker.**

Residual Current Device

With an integrated universal current-sensitive residual current monitoring unit inside, the inverter is able to distinguish the fault currents from normal capacitive leakage currents. The inverter will disconnect from mains as soon as a fault current of more than limit value has been detected.

However if an external RCD or residual current breaker is mandatory, the switch must trigger at a failure current of 300mA or higher.

Requirements of Multiple Inverters in Parallel Grid Connection

If several inverters are operated in parallel connection to grid, different requirements should be obeyed (See technical information "***System Impedance and Stability Recommendation for Multiple String Inverters in Large PV Power Plant***" in the download area of Sungrow website).

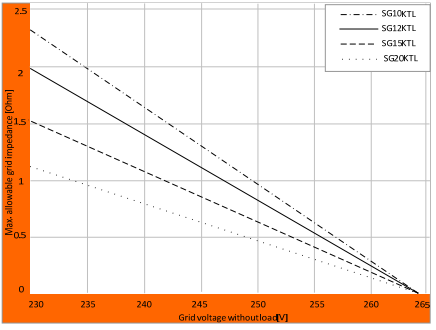
AC Cable Requirements

The grid is connected with the inverter via 5 wires (L1, L2, L3, N and PE). Feed-in power is always three-phase via AC terminal at the bottom of the unit.

A five-core AC waterproof direct plug-in connector is supplied for AC connection, which mates with AC terminal at the underside of the unit.

Consider the following facts when select AC cables specifications and types:

- The grid impedance of the AC cable must correspond to the specification to avoid unintended disconnection from the grid or derating of the output power.



- The maximum cable lengths dependent from the cable cross section are shown in the following table, avoiding power loss in cables of more than 1% of nominal inverter rating.

Type	Conductor Cross Section (mm^2)		Outer cable diameters (mm)	
	Range	Recommended Value	Range	Recommended Value
SG10KTL	4…8.37 (11AWG…8AWG)	4.0 (11AWG)	11…20*	15
SG12KTL				
SG15KTL	4…8.37 (11AWG…8AWG)	6.0 (9AWG)	11…20*	15
SG20KTL	6…10 (10AWG…7AWG)	8.37 (8AWG)	15…25	20

Note: *for cable diameters 11…13 mm use external cable clamp

- Withstand ambient temperature;
- Layout type (inside wall, underground, free air etc.);
- UV resistance and so on.

6.3.2 Connecting Inverter to AC Grid

⚠ DANGER

Danger to human life due to high voltage existing inside the inverter!

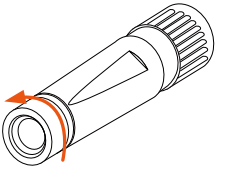
- **Make sure that all the AC cables to the inverter are not live before the electrical work.**
- **Do not turn on the AC side circuit breaker until all inverter electrical connections are completed.**

Prior to connecting to the utility grid, verify whether the grid voltage and frequency are within the range of inverter output parameters, referred to "Appendix". Consult local grid company for solution, if otherwise.

Connect the inverter exclusively to TN or TT mains as the following procedures:

Connecting SG10KTL/SG12KTL/SG15KTL to AC Grid

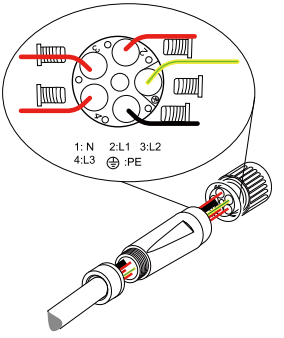
Step 1 Unscrew the water-proof terminal in the following direction.



Step 2 Insert appropriate size AC cables into the water-proof terminal.

Step 3 Strip off insulation layer of all AC cables. The length of strip insulation is approximately 5mm.

Step 4 Fix all cables ends to the corresponding terminals with the torque of 1 N·m according to markings on the connector, especially "PE" cable. If a phase wire is connected to the "PE" terminal, it may permanently destroy the inverter.



Step 5 Pull cables outwards to confirm whether they are installed firmly.

Step 6 Combine the two front-end parts together with the torque of 2 N·m.

Step 7 Tighten the water-proof terminal with the torque of 5 N·m in opposite directions.

Step 8 Make sure the AC and DC circuit breaker are disconnected.

Step 9 Connect phase cables and "N" cable to AC circuit breaker.

– Plug AC connector to corresponding AC terminals.

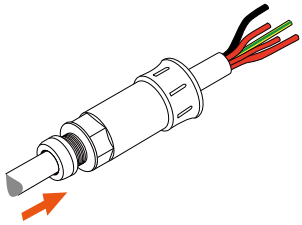
– Screw AC cables except the "PE" cable to the AC circuit breaker.

Step 10 Connect AC circuit breaker to utility grid.

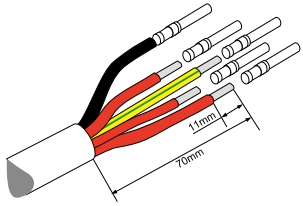
Step 11 Make sure all AC cables are firmly installed.

Connecting SG20KTL to AC Grid

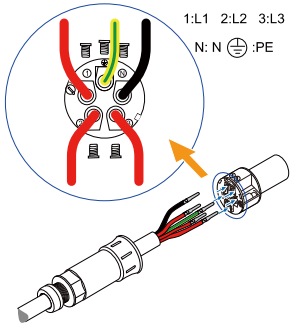
Step 1 Insert AC cables into cable gland and threaded sleeve into the strain relief housing.



Step 2 Strip off 11mm insulation layer from all AC cables. Assemble crimp contacts to wires using crimp technology.



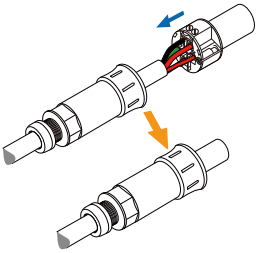
Step 3 Fix all cables ends to the corresponding terminals with the torque of 2.7 N·m according to markings on the connector, especially the "PE" cable.



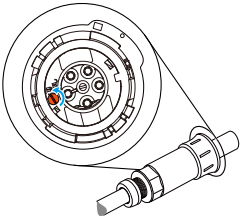
NOTICE

- **Observe the AC terminal layout. Device will not work normally if the phase cable is connected to the PE terminal.**

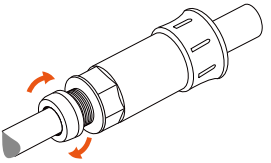
Step 4 Latch the contact carrier.



Step 5 Fasten the contact carrier.

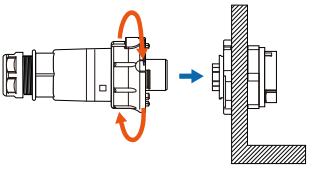


Step 6 Tighten the gland using the torque of 12 N·m.



Step 7 Disconnect AC circuit breaker and prevent it from reconnecting accidently.

Step 8 Plug AC connector into corresponding AC terminal underneath the inverter. And bayonet lock with integrated protection against accidental disconnect.



Step 9 Connect "PE" cable to the grounding electrode. Where there are multiple inverters in the PV power system, connect "PE" cables of all inverters and mounting frame of PV arrays to the same copper bus bar, which may establish equipotential connection.

Step 10 Connect phase cables and "N" cable to the AC circuit breaker.

Step 11 Check whether cables are firmly secured.

No consuming load may be connected to power supply cables from the inverter to the AC circuit breaker.

In addition, ensure that the ground cable is laid far away from and not directly in parallel to the power supply cable.

6.4 Connecting Inverter to PV Arrays

DANGER

Lethal voltage exists!

PV arrays produce electrical energy when exposed to light and thus can create an electrical shock hazard. Wiring of the PV arrays should only be performed by qualified personnel.

WARNING

Before connecting the PV arrays to the inverter, make sure that the impedances between the positive terminal of the PV string and Earth and the impedances between the negative terminal of the PV string and Earth are larger than 1Mohm.

6.4.1 PV Inputs Configuration

SG10/12/15/20KTL inverters have two PV input areas DC1 input and DC2 input, each with its MPP tracker. The two PV input areas can work in Independent mode or parallel mode, set by LCD display menu (see "***10.13 PV Configuration Mode Setting***").

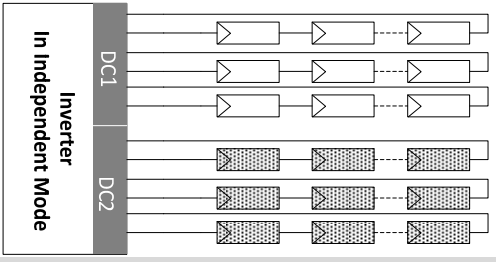
You may see technical information ***"PV Configuration Mode Selection Guide"*** in the Sungrow website to decide the PV configuration mode for inverter

NOTICE

The mode in which actual PV strings are connected and the mode that is set in the inverter LCD display menu should be identical. Otherwise inverter will not work normally.

Independent Mode

In independent mode, the two input areas work independently, as shown in the following diagram.



To make sure the maximum DC power can be utilized, PV strings connected to individual input area should have a homogenous structure, including the same type, the same number, identical tilt and identical orientation.

Prior to connecting inverter to PV inputs, the following specifications should be met:

Type	Total DC Power Limit for Inverter	DC Power Limit for Each Input	Open-circuit Voltage Limit for Each Input	Short-circuit Current Limit for Each Input
SG10KTL	10800W	5400W	1000V	25A
SG12KTL	12800W	6400W	1000V	25A
SG15KTL	15800W	7900W	1000V	25A
SG20KTL	21000W	10500W	1000V	25A

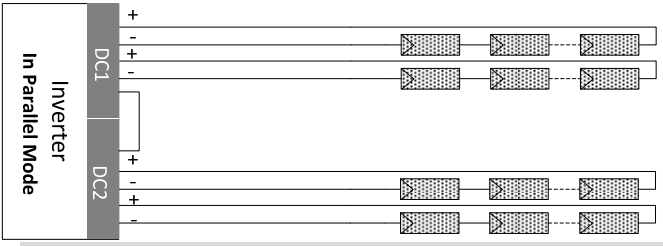
NOTICE

There is a risk of inverter damage! The following requirements should be met; otherwise they will lead to loss of any or all warranty rights.

- **Make sure that the maximum short circuit current of each DC input is less than the inverter allowable limit.**
- **Make sure that the maximum open voltage of each string is less than 1000V. Voltage over 1000V can damage the inverter.**

Parallel Mode

In parallel mode, the PV inputs can be connected in parallel, with sharing the same MPPT, as the following diagram shown. One pair of DC terminals in DC1 input and DC2 input must be short-circuited.



To make sure the maximum DC power can be utilized; All PV strings connected to inverter should have a homogenous structure, including the same type, the same number, identical tilt and identical orientation.

Prior to connecting inverter to PV inputs, the following specifications should be met:

Type	Total DC Power Limit for Inverter	Open-circuit Voltage Limit for Each Input	Short-circuit Current Limit for Total Input
SG10KTL	10800W	1000V	50A
SG12KTL	12800W	1000V	50A
SG15KTL	15800W	1000V	50A
SG20KTL	21000W	1000V	50A

NOTICE

There is a risk of inverter damage! The following requirements should be met; otherwise they will lead to loss of any or all warranty rights.

- **Make sure that the maximum short circuit current of each DC input is less than the inverter allowable limit.**
- **Make sure that the maximum open voltage of each string is less than 1000V. Voltage over 1000V can damage the inverter.**

6.4.2 Assembling DC Cable to Connector

DC cables from PV strings should be equipped with DC connectors. Pairs of DC connectors are supplied in the scope of delivery.

To maintain IP65 weatherproof function of inverter, only the supplied DC connectors or the connectors of the same protection class can be used.

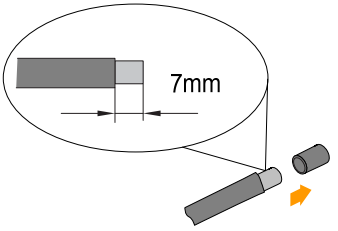
DC Cable Requirements

Cross-section Area Range	Outer cable diameters	Max. Withstand Voltage	Max. Withstand Current
4...6mm^2 12AWG…10AWG	6…9mm	1000V	Same with short-circuit current

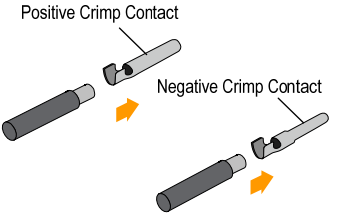
Assembling Procedures

The positive and negative connectors, marked with polarity symbols will be assembled with colored cables as the following procedures:

Step 1 Strip off 7mm insulation layer from all DC cables.



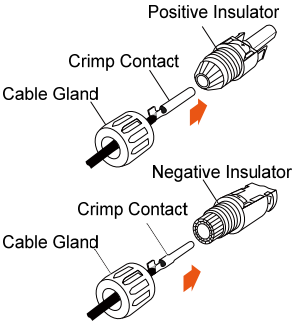
Step 2 Assemble cable ends with crimp contacts by crimping pliers.



Step 3 Lead cable through cable gland.

Step 4 Insert the crimp contact into the insulator until it snaps into place. Then pull gently to check if it is correctly engaged.

Step 5 Screw the cable gland to front insulator with tightening torque 2.5…3 N·m.



For parallel-mode with 5 or 6 strings you may need the T-connector solution with MC4-type T-connectors for connection. Order the MC4 T-connectors from Sungrow or connector manufacture.

6.4.3 Wiring Procedures

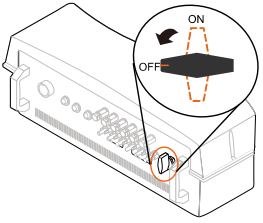
DANGER

Make sure that all the DC cables to the inverter are not live before you start the electrical work.

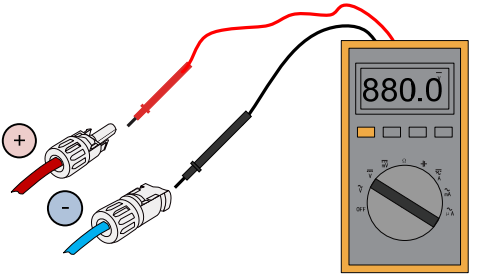
PV Connection of Independent Mode

Connect the inverter to PV arrays as the following procedures:

Step 1 Manually rotate the DC switch at the bottom to the "OFF" position.



Step 2 Check the connection cable of PV string for the correct polarity and that the open-circuit voltage does not exceed the inverter input limit 1000V, even under the lowest operating temperature.



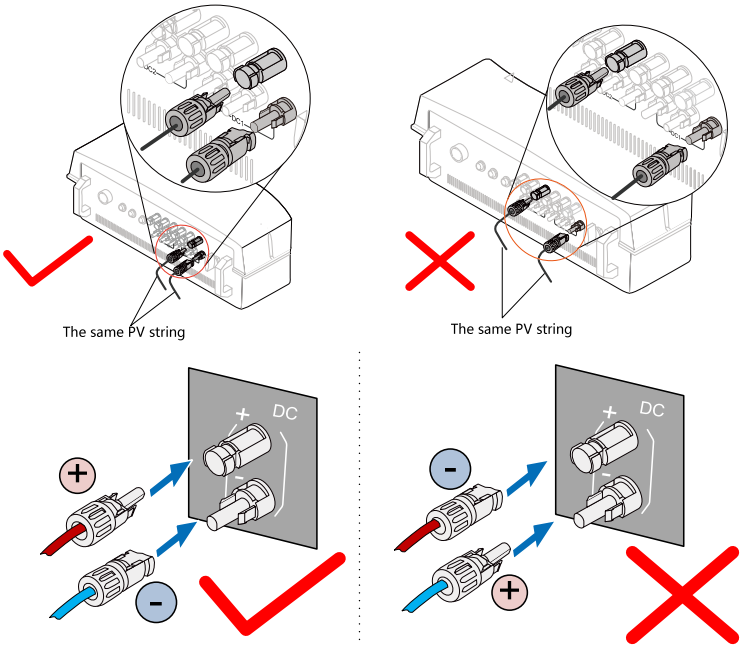
NOTICE

Check the positive and negative polarity of the PV cells. After confirmation, you can insert the DC connectors into the input terminals on the bottom of the inverter.

For the same MPPT, reverse connection of a single string is prohibited. A permanent failure of the system or inverter may follow if otherwise.

Step 3 Plug the positive and negative DC connectors into corresponding terminals until it click-locks into place.

It must not be connected to the different input areas for this PV string.

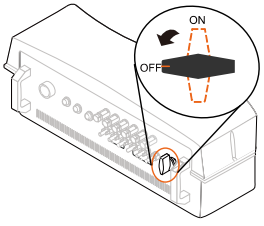


Step 4 Connect other PV strings following the same procedures if necessary. Unused DC terminals should be sealed.

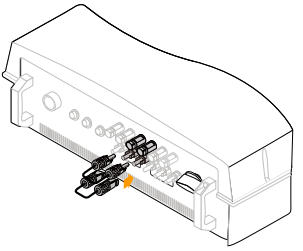
PV Connection of Parallel Mode

Connect the inverter to PV arrays as the following procedures:

Step 1 Manually rotate the DC switch at the bottom to the "OFF" position.



Step 2 Short connected the two input areas as the following indications before any PV string connection.



Step 3 Check the connection cable of PV string for the correct polarity.

Step 4 Plug the positive and negative DC connectors into corresponding terminals until it click-locks into place.

Step 5 Connect other PV strings in the same procedures if necessary. Unused DC terminals should be sealed.

6.5 Grounding the Inverter

WARNING

Because of the transformer-less design of the inverter, the DC positive pole and DC negative pole of the PV arrays are not permitted to be grounded.

6.5.1 Grounding System Overview

All non-current carrying exposed metal parts of the equipment and other enclosures in the PV power system should be grounded (e.g., PV arrays frame and inverter enclosure).

Where there is only one inverter in the PV power system, connect "PE" cable to the installation ground.

Where there are multiple inverters in the PV power system, connect "PE" cables of all inverters and mounting frame of PV arrays to the same copper bus bar. In this way, it will establish equipotential connection.

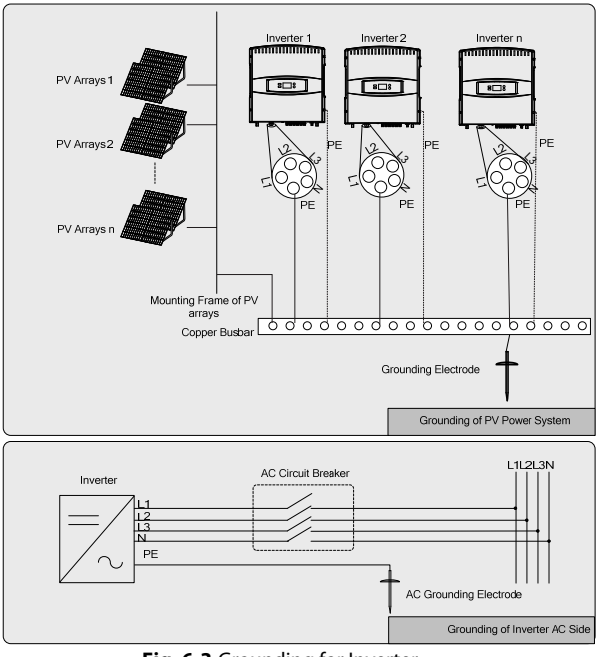


Fig. 6-3 Grounding for Inverter

6.5.2 Second Protective Earth Terminals

The inverters are equipped with second protective earth terminals as specified in EN 50178.

Second PE Terminals

There are two second PE terminals on both sides of the inverter. Users may choose one of them for PE connection.

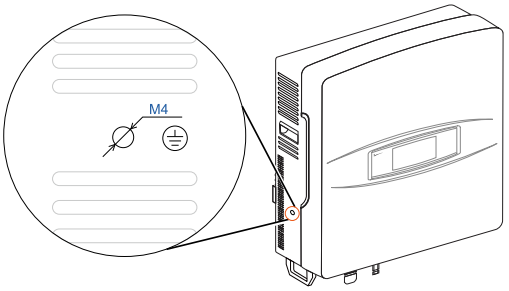
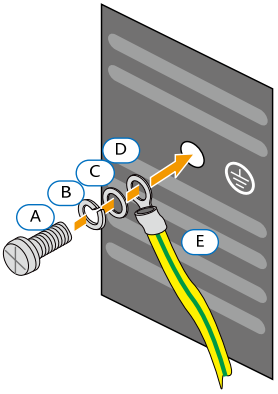


Fig. 6-4 Second PE Terminals

Second PE Connection



Item	Description	Remark
A	Screw	M4×12mm
B	Lock washer	-
C	Washer	-
D	Cable socket	-
E	Yellow-green cable	6mm^2(9AWG)

Fig. 6-5 Connection of the Second PE Connection

*The connection parts are not included in the delivery scope.

6.6 Communication Connection

6.6.1 Communication Overview

The inverter operation information can be transferred via its integrated RS485 interface to a PC with monitoring software (such as SolarInfo Insight) or to data logging device (such as SolarInfo Logger).

RS485 is the standard communication choice for inverter.

RS485 terminals on the bottom of the inverter are RJ45 sockets. First prepare

communication cable and RJ45 plug (may not supplied with inverter). Meanwhile there are waterproof communication connectors supplied in the scope of delivery, to guarantee inverter protection degree.

CAUTION

Lighting protection is recommended to the communication cables when installing this device in thunderstorm-prone areas.

NOTICE

RS485 cable' requirements to ensure the quality of communication:

- **Shielding Ethernet cable**
- **Twist-pair type cable**

A converter such as RS485-232 converter or SolarInfo Logger, which converts 485 to 232 signal, is needed between inverter and PC.

6.6.2 Communication System

For Single Inverter

Where there is only one inverter, a RS485 cable with RJ45 connector enables connection between inverter and PC.

If the communication distance is more than 100m, the communication system must be terminated with a resistor of 120 Ω.

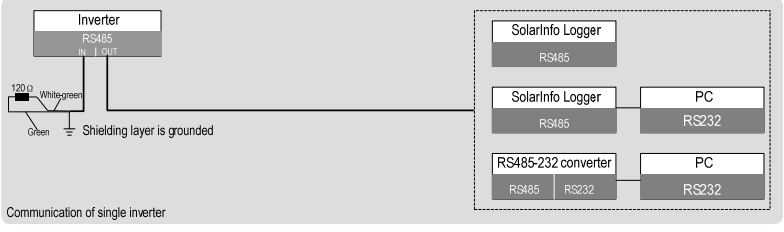


Fig. 6-6 One Inverter Connected to PC or SolarInfo Logger

For Multiple Inverters

Where there is more than one inverter, all inverters can be connected to PC in daisy chain. The first inverter in the chain must be terminated with a resistor of 120 Ω. The

shielding layer of RS485 cable should be single-point grounded.

The maximum number that inverters are connected in the daisy chain depends on converter, data logging device and other factors. Please refer to converter's or data logging device's manual to obtain the limit.

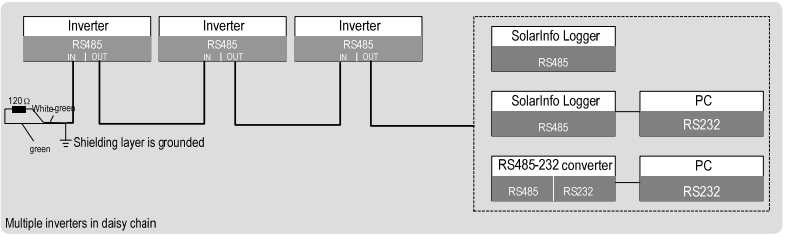
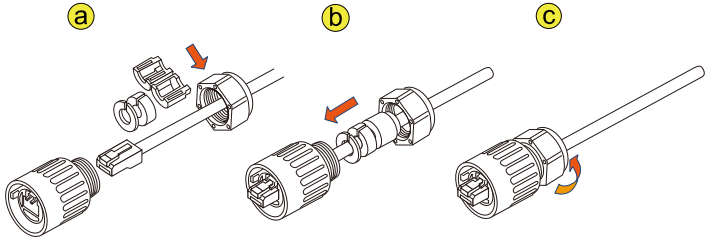


Fig. 6-7 Multiple Inverters Communication with Other Devices

6.6.3 RS485 Communication Connection

Step 1 Insert the RJ45 plug into the front plug connector until it makes a clicking sound, install the plastic rings then tighten the cable gland with appropriate torque.

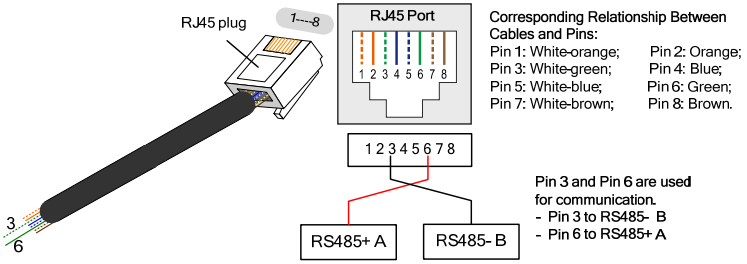


Step 2 Insert connector of one cable end into RS485 in/RS485 out terminal on the bottom of the inverter. Make connector and RS485 terminal engage and rotate clockwise.

Step 3 According to the position of the inverter, repeat step 1…2 to connect the other Ethernet cables to the RS485 in/RS485 out. Ethernet cables with RJ45 plugs can be directly used to connect between the inverters and form a communication daisy chain.

Step 4 Pull cables outwards to confirm whether they are fastened firmly.

Step 5 As for the wires which connect to the terminating resistor or logging devices, use the Ethernet wire stripper to strip the insulation layer and connect the RS485 A and B cables (6 and 3) to terminating resistor or data logging device or RS 485-232 converter.

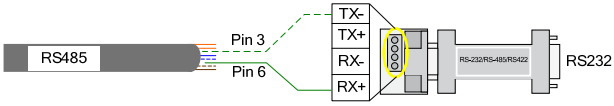

RJ45 plug
1
8
RJ45 Port
1 2 3 4 5 6 7 8
Corresponding Relationship Between Cables and Pins:
Pin 1: White-orange; Pin 2: Orange;
Pin 3: White-green; Pin 4: Blue;
Pin 5: White-blue; Pin 6: Green;
Pin 7: White-brown; Pin 8: Brown.
1 2 3 4 5 6 7 8
Pin 3 and Pin 6 are used for communication.
- Pin 3 to RS485- B
- Pin 6 to RS485+ A
3
6
RS485+ A
RS485- B

Step 6 Connect the other devices. Communication terminal definition is referred to device manual.

Step 7 Verify the communication connection and configure the communication parameters.

If there is more than one inverter to communicate with a PC or a data logger, it is crucial to configure the communication parameters of each inverter. See 10.12 Communication Parameters Setting.

SolarInfo logger and RS485-232 converter are optional parts and can be ordered from Sungrow.



7 Commissioning

Commissioning is a critical part for a well-installed PV system, which can protect against fires, injury and electrical shock.

7.1 Inspection before Commissioning

Before starting the inverter, you should check the following items should be checked for requirements.

Inverter unit is accessible for operation, maintenance and service.

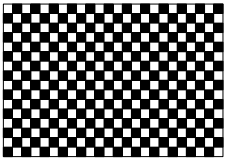
1. Re-check that the inverter is firmly installed onto the wall.
2. Space for ventilation well is provided for one inverter or more than one inverter.
3. Nothing is left on the top of the inverter unit.
4. Inverter and accessories are correctly connected.
5. Cables are routed in safe place or protected against mechanical damage.
6. Specification of AC circuit breaker is reasonable.
7. Terminals not used underneath the inverter are sealed.
8. Warning signs & labels are suitably affixed and durable.

7.2 Commissioning Procedure

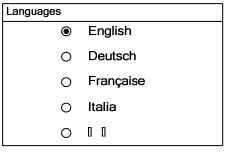
If all checking items mentioned above meet the requirements, precede the following procedures to start up the inverter for the first time.

Step 1 Close external AC circuit breaker.

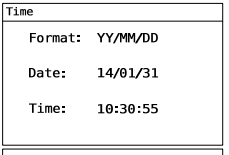
Step 2 Rotate DC switch to "ON" position.
Suppose there are sufficient sunlight and enough DC power. PV arrays initialize and supply DC power to inverter. The LCD display is activated to check the validity first. If there is a defect on the display, contact Sungrow.



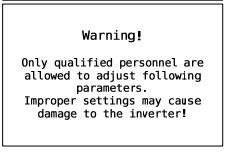
Step 3 Language selection screen will prompt. Perform language settings with the right two buttons. Detailed button functions can be referred to "10.1 Description of Button Function". **Press** ▼ to choose language as you prefer. Confirm the settings by **Pressing ENTER**.



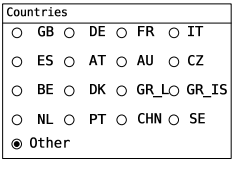
Step 4 Configure time according to the local time. Time setting is very important, which directly affects data logging. **Press** ➤ to move cursor and **Press** ▼ to scroll up time value. Confirm the settings by **Pressing ENTER**.



Step 5 Select the country code according to the inverter's installation country. Each country code represents corresponding local protective parameters that have been preset before delivery. Before country setting, there is warning screen.


Warning!
Only qualified personnel are allowed to adjust following parameters.
Improper settings may cause damage to the inverter!

Step 6 **Press** ▼ to choose country code. Confirm the settings by **Pressing ENTER**.

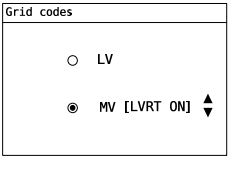


Refer to "10.11 Protective Parameters Setting" for country code explanation. If the inverter is installed where the country code is not included, please choose item "Other" and manually set the protective parameters.

⚠ CAUTION

If the country code is not set correctly during commissioning, reset the protective parameters as dictated in "10.11 Protective Parameters Setting". There may be faults if otherwise.

Step 7 Configure grid code on the display. **Press** ▼ to select grid code. Confirm the selection by **Pressing ENTER**. Where, LV indicates Low Voltage Grid Code; MV indicates Middle Voltage Grid Code.

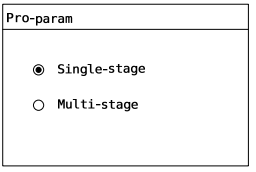


When choose MV, **Press** ➤ to enter the LVRT function selection, **Press** ▼ to switch on or off the LVRT function and **Press ENTER** to confirm the selection.

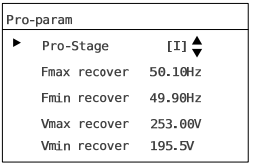
If the Country selected does not have the "Grid codes" directives, this configuration will not affect the following procedures.

However, you may select the MV to enable/disable the LVRT function regardless of the country selected.

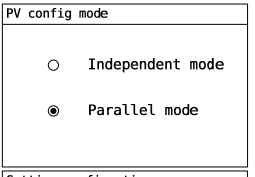
Step 8 After configuring the Grid Code, there will be a "Pro-param" type selection screen and then corresponding sub-menu will come up. For detailed information, please refer to "10.11 Protective Parameters Setting".



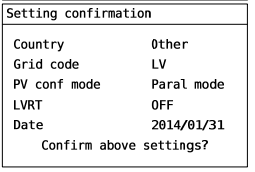
IT(Italy)



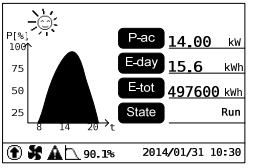
Step 9 According to the actual PV strings configuration mode, choose the same mode in the inverter by the LCD display menu (see "10.13 PV Configuration Mode Setting").



Step 10 After configuring all parameters, there will be a "setting confirmation" screen. Check whether all above-mentioned parameters are correct. Confirm by **Pressing ENTER**. Cancel by **Pressing ESC** and reset.



Step 11 Inverter will enter into startup process. Observe status of LED indicators and the LCD main screen. If inverter's commissioning succeeds, the "RUN" indicator will be lit and "RUN" will be displayed on the "State" area.



If inverter's commissioning fails, the "FAULT" indicator will be lit and "fault" will occur on the display. **Press** ▼ to view "current fault" information. Remove the existing malfunction and then repeat starting up inverter as the above procedures.

8 Disconnecting, Dismantling and Disposing the Inverter

8.1 Disconnecting the Inverter

For maintenance work or any service work, inverter must be switched off. In normal operation, switching off is not necessary.

In order to disconnect the inverter from the AC and DC power sources, you should proceed with the following procedures. Otherwise you will be exposed to lethal voltages or the inverter will be damaged.

Step 1 Disconnect the external AC circuit breaker and prevent it from connecting again.

Step 2 Rotate DC switch to the "OFF" position and then turn off the upstream DC circuit break or pull off the MC4 terminal.

NOTICE

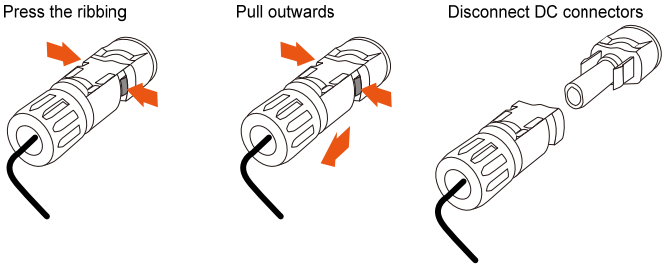
Please strictly follow the above sequence. Inverter will not work normally if otherwise.

Step 3 Wait about ten minutes until the capacitors inside the inverter have discharged.

Step 4 Measure to confirm AC output of inverter at the AC circuit breaker is voltage free.

Step 5 Pull AC connector out of the inverter.

Step 6 Release the locking part of DC connectors by pressing on the ribbing of the locking hooks with nipper pliers and pull it outwards.



8.2 Dismantling the Inverter

Refer to Chapter 5 and Chapter 6 to dismantle the inverter in reverse steps.

NOTICE

If the inverter will be reinstalled in the future, please refer to *4.4* Storage of Inverter for a proper conservation.

8.3 Disposing the Inverter

Users should take the responsibility for the disposal of the inverter.

NOTICE

Some parts and devices in the inverter, such as LCD displayer, batteries, capacitors, may cause environment pollution. Users must comply with the related local regulations to avoid causing pollution.

9 Troubleshooting and Maintenance

9.1 Troubleshooting

9.1.1 Troubleshooting of LED Indicator

See "Tab. 2-1 Description of LED Indicator" for definition of LED's states.

Type of fault	Troubleshooting
LED indicators and LCD screen cannot be lit	1. Disconnect AC side circuit breaker. 2. Rotate the DC Switch to the "OFF" position. 3. Check the polarity of DC input.
"RUN" indicator goes out	1. Disconnect AC side circuit breaker. 2. Rotate the DC Switch to the "OFF" position. 3. Check the correctness of electrical connection of inverter. See "6 Electrical Connection". 4. Check whether DC input voltage exceeds the inverter start voltage of inverter. 5. If all above conditions are OK, please contact with Sungrow.
"Fault" indicator is lit	1. A fault is not removed yet. 2. Perform troubleshooting in according to fault type in LCD screen. See "9.1.2 Troubleshooting of Faults in LCD Screen". 3. If it cannot be solved, please contact Sungrow.

9.1.2 Troubleshooting of Faults in LCD Screen

When faults occur, "Fault" state will be shown on the main screen. **Press** ▼ to view multiple "current fault" information pages.

Fault Code	Description	Troubleshooting
002	The grid voltage has exceeded inverter allowable upper limit.	1. Check the voltage of the grid. 2. If the grid voltage exceeds the permissible range of inverter protective parameters, ask utility grid company for solution. 3. If the grid voltage is within the permissible range, contact Sungrow Service Dept..
003	Inverter has checked that the instantaneous sample value of the grid voltage exceeds the allowable limit for some time.	1. This is a short-term fault due to grid condition. Wait a moment for inverter recovery. 2. If the fault still exists, please contact Sungrow Service Dept..
004	The grid voltage has fallen below inverter's allowable lower limit.	1. Check the voltage of the grid. 2. If the grid voltage exceeds the permissible range of inverter protective parameters, ask utility grid company for solution. 3. If the grid voltage is within the permissible range, contact Sungrow Service Dept..
005	The grid voltage is too low.	1. This is a short-term fault due to grid condition. Wait a moment for inverter recovery. 2. If the fault still exists, please contact Sungrow Service Dept..
006	The AC output current exceeds inverter protective limit.	1. The inverter will resume if the output current falls below the protective value. 2. If the fault still exists, please contact Sungrow Service Dept..
007	Inverter has checked AC overcurrent temporarily.	The inverter will self-recover after several seconds.
008	The grid frequency has exceeded inverter allowable upper limit.	1. Check the frequency of the grid. 2. If the grid frequency exceeds the permissible range of inverter protective parameters, ask utility grid company for solution. 3. If the grid frequency is within the permissible range, contact Sungrow Service Dept..
009	The grid frequency has fallen below inverter allowable lower limit.	

Fault Code	Description	Troubleshooting
010	Islanding	1. Check whether AC circuit breaker is triggered. 2. Check whether AC cables are all firmly connected. 3. Check whether grid is not on service. 4. If all conditions are OK and this malfunction still occurs in the LCD screen, contact Sungrow Service Dept..
011	The DC component of AC current has exceeded inverter limit.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
012	Inverter has detected that there is a failure current.	1. Check the PV strings for ground fault. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
013	Inverter has checked that the grid is abnormal	1. Wait a moment for grid recovery. 2. If the grid parameters exceed the permissible range of inverter protective parameters, ask utility grid company for solution. 3. If the grid frequency is within the permissible range, contact Sungrow Service Dept..
014	The average grid voltage over 10 minutes is not within the permissible range.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
015	Grid impedance has exceeded inverter limit	1. Check AC cables for appropriate size. 2. Wait a moment for inverter recovery. 3. If the fault occurs repeatedly, contact Sungrow Service Dept..
016	The AC output overloads.	1. Wait a moment for inverter recovering. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
017	The inverter has checked that there is unbalance between the three phase voltages.	1. Wait a moment for inverter recovering. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
019	The bus voltage is temporarily high.	1. Wait a moment for inverter recovering. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
020	The bus voltage is high.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
021	Inverter has checked that there	Check the layout and the wiring of PV1

Fault Code	Description	Troubleshooting
	is overcurrent of PV1 input.	input.
022	Inverter has checked that there is overcurrent of PV2 input.	Check the layout and the wiring of PV2 input.
023	PV configuration mode has changed during inverter running.	Check the PV input configuration mode and restart the inverter when necessary.
024	Inverter has checked the deviation of neutral point voltage.	1. Inverter will recover if the deviation value falls below the protective limit. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
025	Inverter has checked out the unbalance of neutral point voltage temporarily.	1. Inverter will recover if the deviation value falls below the protective limit. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
026	There is high Bus fluctuation voltage.	1. This is a short-term fault. Wait a moment for inverter recovery. 2. If the fault still exists, please contact Sungrow Service Dept..
027	The DC current is not balanced between the two PV inputs for parallel PV configuration mode.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
036	The temperature of module is too high	1. Check whether AC output power exceeds nominal power too much. 2. Check whether fans work normally and whether there are some abnormal fans. Please replace broken fan, in necessary. 3. Clean air grills of outlet. 4. If the fault still exists, please contact Sungrow Service Dept..
037	The ambient temperature is too high	
038	The inverter has checked that there is a fault of relay.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
039	The insulation resistance is low. (ISO-flt)	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
040	IGBT saturation	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
041	There is a fault with sampling channel.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
042	Current imbalance.	If the fault occurs repeatedly, contact Sungrow Service Dept..
043	The ambient temperature falls	Disconnect inverter to stop. Wait for

Fault Code	Description	Troubleshooting
	below -25℃	ambient temperature to rise above -25℃ and then start inverter again.
044	There is a fault with DC/AC inversion circuit	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
045	There is a fault with PV1 boost circuit.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
046	There is a fault with PV2 boost circuit.	
047	The PV configuration mode set on the display is not in accordance with the configuration in the connection cabinet.	1. Disconnect inverter. 2. Re-select PV configuration mode and re-connect PV strings. For more detailed information, please refer to "6.4 Connecting Inverter to PV Arrays".
048	Phase-R current sampling channel fault.	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
049	Phase-S current sampling channel fault.	
050	Phase-T current sampling channel fault.	
051	Hardware Overvoltage/ Overcurrent protection	1. Wait a moment for inverter recovery. 2. If the fault occurs repeatedly, contact Sungrow Service Dept..
070	Fans are defective.	Disconnect inverter and remove the broken fan.
071	Fault with AC SPD	It is necessary to replace the AC SPD. Contact Sungrow Service Dept..
072	Fault with DC SPD	It is necessary to replace the DC SPD. Contact Sungrow Service Dept..
073	Fuse has blown out	Disconnect inverter and replace the fuses. Contact Sungrow Service Dept...
074	Communication fault of LCD	A fault has occurred in the internal communication of the inverter. However, the inverter continues feeding into the grid. Contact Sungrow Service Dept..
075	Solar irradiation is not sufficient for inverter operation.	Wait for higher irradiation. If this recurs at medium irradiation, check the PV system design and correct the connection of PV inputs.
076	PV1 overload	Check the PV system design and correct the connection of PV inputs.
077	PV2 overload	Check the PV system design and correct the connection of PV inputs.

9.2 Maintenance

9.2.1 Routine Maintenance

Items	Methods	Period
System clean	Check the temperature and dust of the inverter. Clean the inverter enclosure. Check the humidity and dust of the environment. Meanwhile check whether the filter function of the air inlet is ok. Clean the air inlet and outlet, when necessary.	Six months to a year (it depends on the dust contents in air.)
Fans	Check whether there is crack of the fan blade Check whether there is any abnormal noise of the fan turning. Clean or replace the fans.	Once a year

9.2.2 Maintenance Instruction

DANGER

Disconnect the inverter from the grid first and then PV arrays before any maintenance work.

Lethal voltage still exists in the inverter. Please wait at least ten minutes and then perform maintenance work.

Cleaning Fan

There are four fans in the inverter for ventilation. It is recommended that the fans are cleaned every six months.

Step 1 Disconnect the output and input side.

Step 2 Wait for at least ten minutes.

Step 3 Dismantle the inverter in the reversed direction of "Installation procedure".

Step 4 Loosen the fixed screws on the back of the inverter.

Step 5 Clean the fan with soft brush or vacuum cleaner.

Step 6 Reinstall the inverter.

Step 7 Re-connect the inverter.

Step 8 Restart the inverter.

Replacement Fan

If there is overheat and abnormal noise, please replace the fan. This task should be performed by technician.

DANGER

- **Disconnect the inverter from the grid first and then PV arrays before any maintenance work.**
- **Lethal voltage still exists in the inverter. Wait for at least ten minutes and then perform the maintenance work.**
- **Fans' maintenance work may only be performed by qualified electricians.**

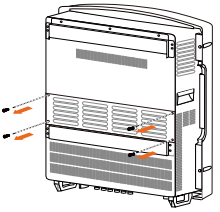
Step 1 Disconnect the AC side circuit breaker.

Step 2 Rotate DC switch to the "OFF" position and then turn off the upstream DC circuit break or pull off the MC4 terminal.

Step 3 Wait for at least ten minutes.

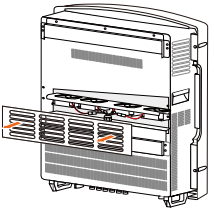
Step 4 Disconnect all electrical connectors at the bottom.

Step 5 Lift up the inverter over the backplate with the help of others and then remove it from the wall.

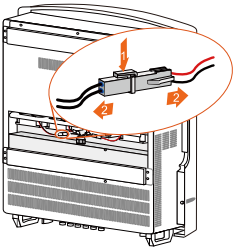


Step 6 Place the inverter onto the platform.

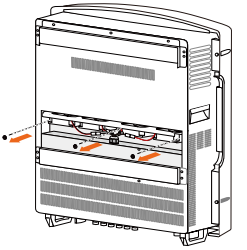
Step 7 Loosen the four screws and disassemble the metal plate as below figures show.



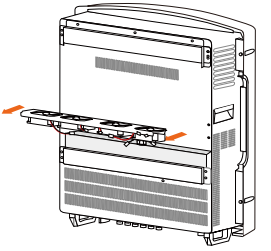
Step 8 Release the locking part of four connectors by pressing on the ribbing of the locking hooks and pull it outwards.



Step 9 Loosen the screws used for fastening the fans bracket.



Step 10 Remove the fan bracket from the inverter.



Step 11 Clean the fans with soft brush or vacuum cleaner. Replace the broken fans if necessary.

Step 12 Re-assemble the fans bracket onto the inverter.

Step 13 Connect the four connectors and fasten them with cable ties.

Step 14 Assemble the plate by fastening the four screws.

Step 15 The inverter can work again.

Air Inlet and Outlet Cleaning

A huge amount of heat is generated with the running of the inverter. The inverter adopts a controlled forced-air cooling method.

Check whether there is anything blocking the air inlet and outlet to maintain good ventilation.

Clean the air inlet and outlet with soft brush or vacuum cleaner if necessary.

9.3 Contact Sungrow Service

Should you have any problems in operating on the inverter, please contact us:

Service hotline: +86 551 6532 7817

Email: service@sungrow.cn

We need the following information to provide you the best assistance:

- Type of the inverter
- Serial number of the inverter
- Fault code/name
- Brief description of the problem

10 Operation of LCD Display Panel

10.1 Description of Button Function

Inverter offers two buttons for the user to look up the running information and configure parameters settings. The two buttons have multiple functions. Please refer to Tab. 10-1before any operation onto inverter.

Tab. 10-1 Button Function

Button	Operation	Description
	Press less than two seconds	Move upwards or downwards, or increase setting value. Hereafter, it is referred to as "Press ▼".
	Press more than two seconds	Return to the previous menu or cancel the command. Hereafter, it is referred to as "Press **ESC**".
	Press less than two seconds	Move left or right, or turn pages. Hereafter, it is referred to as "Press ➤".
	Press more than two seconds	Enter into the sub-screen or confirm the command. Hereafter, it is referred to as "Press **ENTER**".

The background illumination of the LCD screen will go out to save power if there is no button operation for one minute. Reactivate it by pressing any button.

10.2 Inverter Menu Structure

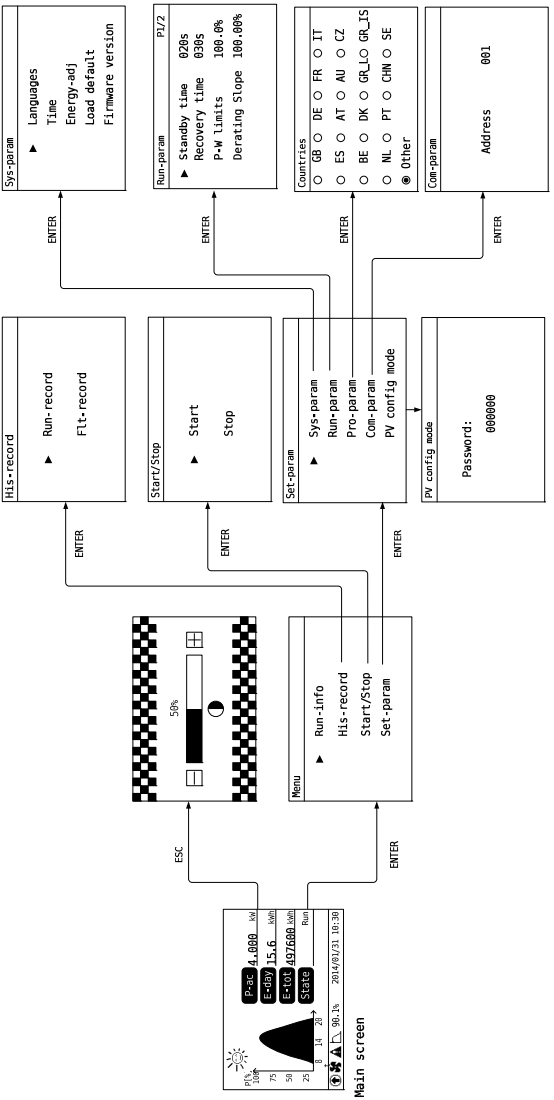


Fig. 10-1 Menu Tree-English

10.3 Main Screen

If the inverter succeeds in commissioning, LCD display will enter into the main screen, as shown in Fig. 10-2.

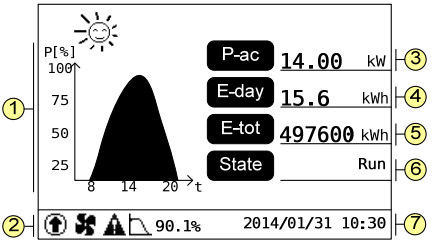


Fig. 10-2 Main Screen Description

No.	Description
1	Power curve. x-axis: time in hours; y-axis: output power yield P in %.
2	Icons (refer to the Tab. 10-3) and the Inverter active power limits (P-W limits).
3	Current output power.
4	Energy generation during this day until now.
5	Total energy generation since initial commissioning.
6	Inverter state.
7	Date (year/month/date) and time.

NOTICE

The energy yields displayed by the LCD panel are indicative only.

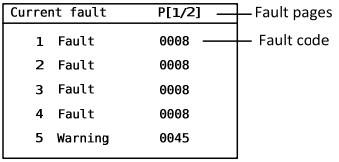
For the actual yields, please refer to the electric energy meter.

Tab. 10-2 Inverter State Description

Inverter State	Description
Run	After being energized, the inverter tracks the PV arrays' maximum power point (MPP) and feeds AC power to grid. This mode is the normal mode.
Standby	Inverter will enter into Standby mode for insufficient input power. In this mode the inverter will wait until the DC voltage recovers.
Stop	The inverter is shut down.
Key-stop	The inverter will stop operation by manual "Stop" through LCD menu.
Start...	The inverter is initializing and synchronizing with the grid.
Upd fail	IAP update fails

Inverter State	Description
Fault	If a fault occurs, the inverter will automatically stop operation, trigger the AC relay and show "Fault" on the LCD with the "FAULT" indicator lit. Once the fault is removed in recovery time (set by user, see "***10.10 Running Parameter Setting***"), the inverter will automatically resume running.
Warning	Inverter has checked out some warning information.

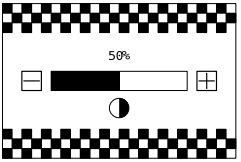
If inverter is in "Fault" state, Press ➤/➘ to view multiple "Current fault" information pages. To know the meaning of the fault code, please refer to "***9.1.2 Troubleshooting of Faults in LCD Screen***".



Tab. 10-3 Icon Description

Icon	Description
	Inverter is in IAP update process.
	Fans inside are working.
	Inverter is warning the running state.
	Inverter in power reduction state.

10.4 Adjust Contrast



Step 1 **Press** ESC to enter into the contrast adjustment screen.

Step 2 **Press** ➘ to increase the setting value and **press** ➤ to decrease the value.

Step 3 **Press** ENTER to confirm the contrast setting.

The contrast value ranges from 0 to 100. The recommended value is 50 or 60.

10.5 Detailed Running Information

On the main screen, there is some basic information about the inverter. For more detailed running information, please operate as follows.

Main Screen (Press ENTER) →Menu→ Run-info (Press ENTER)

LCD screen will show four detailed running information pages. Scroll pages by pressing ➤ /➘.

"DC power input" represents the total input power of PV1 and PV2.
"Vdc" indicates the DC voltage of each input.
"Idc" indicates the DC current of each input.
"Pdc" indicates the DC power of each input.
"Indep mode" is the PV configuration mode of the two PV inputs.
√ indicates the corresponding input is at work.

DC power input		00000W
	PV1	PV2
Vdc[V]	0000.0	0000.0
Idc[A]	000.0	000.0
Pdc[W]	00000	00000
Indep mode	√	√

"P-W" is inverter output active power.
"S-Va" is inverter output apparent power.
"Country" is inverter selected country code.
"Grid code" is inverter selected grid code.

P-W	00000W
S-Va	00000VA
Country	GB
Grid code	LV

"Vac" is phase voltage.
"Iac" is phase current.
"Pac" is AC output of each phase.
"F" is frequency of each phase.

	L1	L2	L3
Vac[V]	000.0	000.0	000.0
Iac[A]	000.0	000.0	000.0
Pac[W]	0000	0000	0000
F[Hz]	00.00	00.00	00.00

"CO2-reduce" indicates total CO2 emission reduction due to the inverter.
"E-month" is the energy generation in this month.
"h-Total" is the total running hours of the inverter.
"T-today" is today running time of the inverter.
"Temp" is the internal temperature of the inverter.

CO2-reduce	00000kg
E-month	00000kWh
h-Total	0000h
T-today	0000min
Temp	000.0°C

NOTICE

The energy yields displayed by the LCD panel are indicative only.

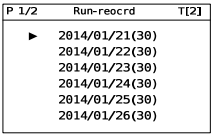
For the actual yields, please refer to the electric energy meter.

10.6 History Records

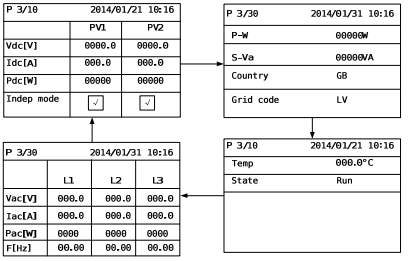
10.6.1 Running Information Records

Main Screen (Press ENTER) →Menu (Press ▼) → His-record (Press ENTER) →Run-record (Press ENTER)

On the "Run-record" display, press ▼ to select the date you want to view. Confirm by pressing **ENTER**.



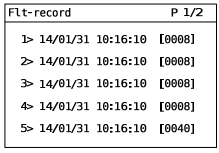
Inverter shows historical running information pages. Scroll pages by pressing ▼. Change to the next record by pressing ➤.



10.6.2 Fault Records

Main Screen (Press ENTER) →Menu (Press ▼) → His-record (Press ENTER, Press ▼) →Flt-record (Press ENTER)

Inverter shows fault record pages. Scroll pages by pressing ▼.

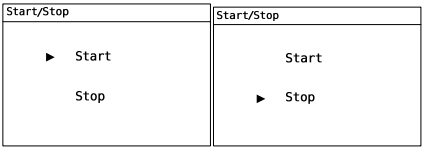


The inverter can only store at most 10 latest fault records.

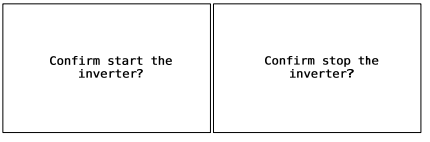
10.7 Start and Stop Inverter

Main Screen (Press ENTER) →Menu (Press ×2) → Start/Stop (Press ENTER)

Press to choose "Start"/"Stop" and **press ENTER** to confirm the choice.



Press ENTER to confirm.



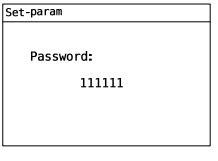
10.8 Input Parameter Settings Password

The parameter settings are protected by the password. If you want to set the inverter's parameters, you have to input the correct password.

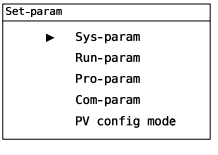
Step 1 **Press ENTER** to enter into "Menu" screen.

Step 2 **Press** to move the cursor to "Set-param" menu item and confirm by **pressing ENTER**.

Step 3 A password confirmation screen will occur. **Press** to move cursor right and **Press** to input the password 111111.



Step 4 **Press ENTER** to confirm the password and enter the "Set-param" sub menu.



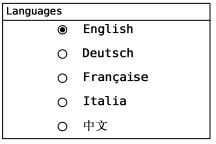
10.9 System Parameters Setting

10.9.1 Language Setting

The inverter supports five languages: English, German, French, Chinese and Italian. Language can be configured as the following indication.

Main Screen(Press ENTER)→Menu screen(Press ▼×3)→Set-param (Press ENTER) → Enter password(Press ENTER) → Sys-param(Press ENTER) → Language (Press ENTER)

Press ▼ to select language as you prefer and confirm it by pressing **ENTER**.

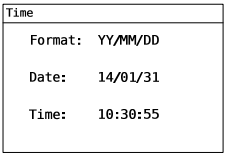


10.9.2 Time Setting

If there is deviation between the time on inverter main screen and your local time, you should perform the operation time setting. Otherwise the inverter data logging will fail. Clock is 24-hour format.

Main Screen(Press ENTER)→Menu screen(Press ▼×3 →Set-param(Press ENTER)→Enter password(Press ENTER)→Sys-param(Press ENTER, Press ▼) →Time (Press ENTER)

On the "Time" screen, **Press ➤** to move the cursor right and **Press ▼** to set the correct date and time.
Confirm settings by **pressing ENTER**.

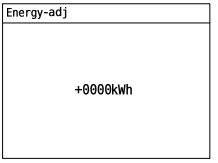


10.9.3 Energy Deviation Adjustment

If the accumulative value of "E-total" in the inverter is different from the value in the external metering device, you should adjust the "Energy-adj" setting.

Main Screen(Press ENTER)→Menu screen(Press ▼×3)→Set-param(Press ENTER)→Enter password(Press ENTER)→Sys-param(Press ENTER, Press ▼×2)→Energy-adj(Press ENTER)

On the "Energy-adj" screen, Press ➤ to move cursor right and **Press** ▼ to set the correct offset value.
Confirm settings by pressing **ENTER**.
The positive symbol "+" can be changed to the negative symbol "-".
The adjustment range is from -9999 to +9999 kWh.
(Energy-adj value)= (Real measured value)-(E-tot reading value).



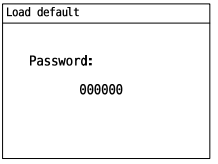
10.9.4 Load Default

NOTICE

All history accumulated information will be unrecoverable cleared and all parameters will return to the default value except the protective parameters and time, once the "load default" operation is performed.

Main Screen(Press ENTER) →Menu screen(Press ▼ ×3) → Set-param (Press ENTER) →Enter password(Press ENTER) →Sys-param (Press ENTER, Press ▼×3) → Load default (Press ENTER)

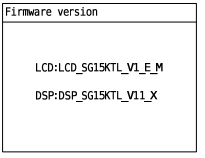
A password confirmation screen will occur. Press ➤ to move cursor right and **Press** ▼ to input the password 111111.
Press **ENTER** to confirm "load default".



10.9.5 Firmware Version

Main Screen(Press ENTER) →Menu screen(Press ▼ ×3) → Set-param (Press ENTER) →Enter password(Press ENTER) →Sys-param (Press ENTER, Press ▼×4) → Firmware version (Press ENTER)

Inverter shows detailed firmware information, including LCD version and DSP version.
The firmware version information is read only.

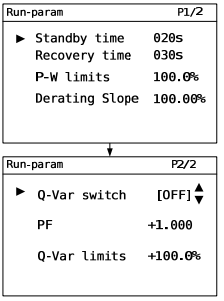


10.10 Running Parameter Setting

10.10.1 Main Screen of Run-param

Main Screen(Press ENTER) →Menu screen(Press ▼ ×3) → Set-param (Press ENTER) →Enter password(Press ENTER, Press ▼) →Run-param (Press ENTER)

On the "Run-param" screen, Press ▼ to select one item and Press **ENTER** to start this item setting.
For each item setting, **Press** ➤ to move the cursor right and **Press** ▼ to set the appropriate value.
Confirm settings by Pressing **ENTER**.



Tab. 10-4 Specification of Running Parameters

Parameter	Explanation	Default	Range
Standby time	The time from inverter initialization to inverter feeding power to grid.	20s	20…255s
Recover time	The time from the fault is cleared to inverter feeding power to grid.	30s [IT: 300s]	0…900s
P-W limits	Inverter active power limits.	100.0%	0...100%
Q-Var switch	Whether to start inverter reactive power adjustment function.	[Pf]	[Pf] / [Qt] / [Off] / [Q(P)] / [Q(U)]
PF	Power factor	+1.000	-1.000…-0.900 / +0.900…+1.000
Q-Var limits	Inverter reactive power limits	0.0%	0...+100% / 0…-100%
*Derating Slope**	Over-frequency power derating slope (Pm/Hz) Only available when the "Countries" is selected to "IT".	83.33%	40%...100%

10.10.2 Reactive Power Regulation

The inverter provides reactive power regulation function. Use the "*Q-Var switch*" parameter to activate this function and select proper regulation mode.

Regulation Mode	Explanation
Pf	The reactive power can be regulated by the parameter *PF (Power Factor)*.
Qt	The reactive power can be regulated by the parameter *Q-Var limits* (in %).
Off	The *PF* is limited to +1.000, and the "*Q-Var limits*" is limited to 0.0%.
Q(P)	The PF changes with the output power of the inverter.
Q(U)	The reactive power changes with the grid voltage.

"*Pf*" Mode

The reactive power can be regulated by the parameter *PF* on the Run-param screen.

"*Qt*" Mode

The reactive power can be regulated by the parameter *Q-Var limits (in %)* on the Run-param screen.

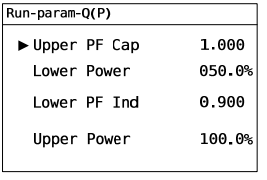
"*Off*" Mode

The *PF* is limited to +1.000, and the *Q-Var limit* is limited to 0.0%.

"*Q(P)*" Mode(when the country selection is not "IT")

The PF changes with the inverter output power.

If the country selection is not "IT" (Italy), after selecting Q(P) Mode, **Press** ▼ to enter the Run-param-Q(P) sub-menu.
For each item setting, **Press** ➤ to move cursor right and **Press** ▼ to set the appropriate value. Confirm settings by Press **ENTER**.



Tab. 10-5 *"Q(P)"* Mode Parameters Explanation

Parameter	Explanation	Default	Range
Upper PF Cap	Power factor of point P1 in the Q(P) mode curve	1	0.9…1
*Lower Power**	Output power of point P1 in the Q(P) mode curve (in %)	50%	0%...50%
Lower PF Ind	Power factor of point P2 in the Q(P) mode curve	0.9	0.9…1

Parameter	Explanation	Default	Range
*Upper Power**	Output power of point P2 in the Q(P) mode curve (in %)	100%	50%...100%

*Lower Power <Upper Power

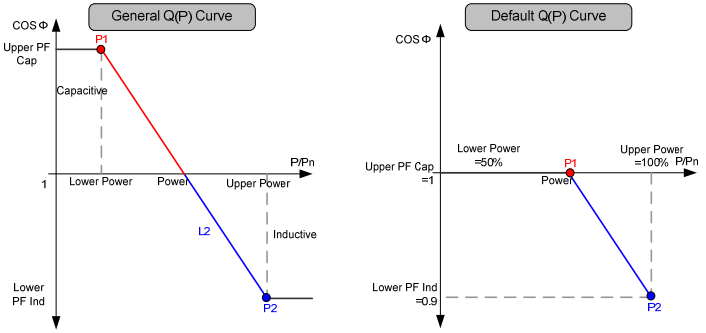
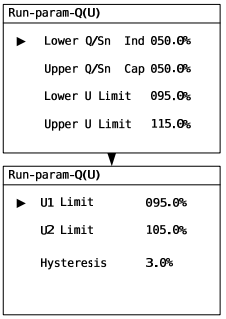


Fig. 10-3 Reactive Power Regulation Curve in Q(P) Mode

"*Q(U)*" Mode(when the country selection is not "IT")

The reactive power ratio changes with the grid voltage.

If the country selection is not "IT" (Italy), after selecting Q(U) mode, **Press** ▼ to enter the Run-param-Q(U) sub-menu.
For each item setting, **Press** ➤ to move cursor right and **Press** ▼ to set the appropriate value.
Confirm settings by Pressing **ENTER**.



Tab. 10-6 "Q(P)" Mode Parameters Explanation

Parameter	Explanation	Default	Range
Lower Q/Sn Ind	Inductive Q/Sn value of point P4 in the Q(U) mode curve	25%	0%...50%
Upper Q/Sn Cap	Capacitive Q/Sn value of point P1 in the Q(U) mode curve	25%	0%...50%
Lower U Limit	Grid voltage limit *(in %)* of point P1 in the Q(U) mode curve	80%	80%...90%
Upper U Limit	Grid voltage limit *(in %)* of point P4 in the Q(U) mode curve	115%	110%...115%

Parameter	Explanation	Default	Range
*U1 Limit**	Grid voltage limit *(in %)* of point P2 in the Q(U) mode curve	95%	95%...100%
*U2 Limit**	Grid voltage limit *(in %)* of point P3 in the Q(U) mode curve	105%	100%...105%
*Hysteresis**	*Hysteresis voltage width (in %)*	3%	0%...5%

*U1 Limit + Hysteresis < U2 Limit - Hysteresis

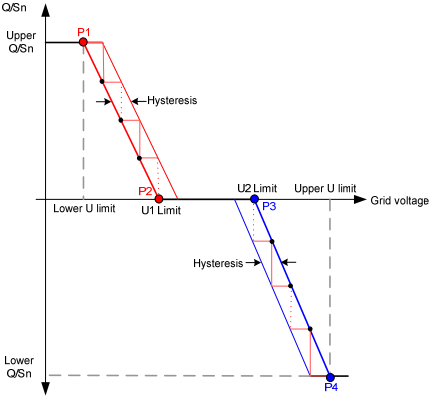
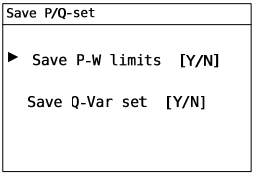


Fig. 10-4 Reactive Power Regulation Curve in Q(U) Mode

10.10.3 Save P/Q-set

On the "Save P/Q-set" screen, **Press** ▼ to move arrow to one item, **Press** ➤ to move cursor right and **Press** ▼ to set.
Confirm by Pressing **ENTER**.

Select "Y" to save up the values set when power down.
Select "N" to restore default values when power down.

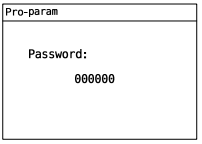


10.11 Protective Parameters Setting

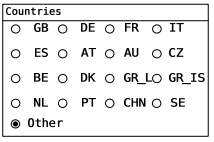
Protective parameters are designed for the limit value that can trigger the protective functions of the inverter.

Main Screen(**Press ENTER**) →Menu screen(**Press** ▼ ×3) → Set-param (**Press ENTER**) →Enter password(**Press ENTER**, **Press** ▼×2) →Pro-param (**Press ENTER**)

A password confirmation screen will occur. Press ➤ to move cursor right and Press ▼ to input the password. Please enquire Sungrow or your dealer for this password.



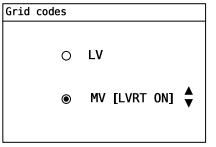
To make protective parameters setting convenient, Inverter provides country code selection. The protective parameters have been configured before delivery according to different countries utility grid requirements. Choose the correct country code by Press ▼ and Press **ENTER** to confirm.



The description of country code is illustrated below:

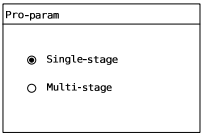
Country Code	Full Name	Country Code	Full Name
GB	Great Britain	DE	Germany
FR	France	IT	Italy
ES	Spain	AT	Austria
AU	Australia	CZ	Czech
BE	Belgium	DK	Denmark
GR_L	Greece Land	GR_IS	Greece Island
NL	Netherlands	PT	Portugal
CHN	China	SE	Sweden
Other	Country not included above	-	-

Confirm by pressing **ENTER** after country code selection. Choose grid code according to actual grid condition.
Note: "LV" represents Low Voltage Grid Code, and "MV" represents Middle Voltage Grid Code.
When choose MV, **Press** ➤ to enter the LVRT function selection, **Press** ▼ to switch on or off the LVRT function and **Press ENTER** to confirm the selection.

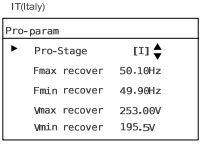


Note: If the Country selected does not have the "Grid codes" directives, this configuration will not affect the following procedures.
However, you may select the MV to enable/disable the LVRT function regardless of the country selected.

Press ▼ to select protective parameter type. Press **ENTER** to confirm the selection.

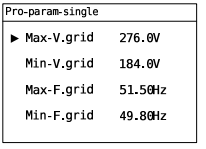


If the country selection is "IT" (Italy), the Pro-param menu right will show, refer to the 10.14.3 Protective Parameters Setting for Italy for detailed settings.



Single-stage Protective Parameters (when the country selection is not "IT")

If the selected protective parameter type is "Single-stage", the following sub-menu will come up.
Press ▼ to select parameter, **Press** ➤ to move cursor right and **Press** ▼ to set the appropriate value. Confirm settings by Pressing **ENTER**.



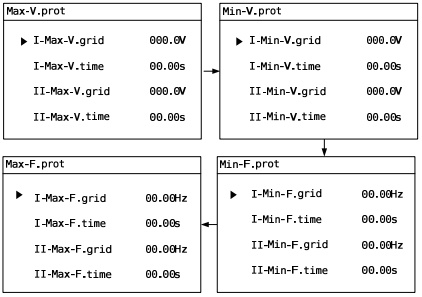
Tab. 10-7 Single-stage Protective Parameters Explanation

Parameter	Explanation
Max-V.grid	Grid over-voltage value
Min-V.grid	Grid under-voltage value
Max-Fgrid	Grid over frequency value
Min-F.grid	Grid under frequency value

Multi-stage Protective Parameters (when the country selection is not "IT")

If the selected protective parameter type is "Multi-stage", the following sub-menus will come up.

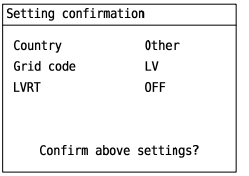
Press ▼ to select parameter, **Press** ▶ to move cursor right and **Press** ▼ to set the appropriate value. Confirm settings by Pressing **ENTER**.



Tab. 10-8 Multi-stage Protective Parameters Explanation

Parameter	Explanation
Max-V. prot	Over-voltage protection
Ⅰ-Max-V. grid	Stage Ⅰ Grid over-voltage (U>)
Ⅰ-Max-V. time	Stage Ⅰ Grid over-voltage (U>) tripping time
Ⅱ-Max-V. grid	Stage Ⅱ Grid over-voltage (U>>)
Ⅱ-Max-V. time	Stage Ⅱ Grid over-voltage (U>>) tripping time
Min-V. prot	Under-voltage protection
Ⅰ-Min-V. grid	Stage Ⅰ Grid under-voltage (U<)
Ⅰ-Min -V. time	Stage Ⅰ Grid under-voltage (U<) tripping time
Ⅱ-Min -V. grid	Stage Ⅱ Grid under–voltage (U<<)
Ⅱ-Min -V. time	Stage Ⅱ Grid under–voltage (U<<) tripping time
Max-F. prot	Over-frequency protection
Ⅰ-Max-F. grid	Stage Ⅰ Grid over-frequency (f>)
Ⅰ-Max-F. time	Stage Ⅰ Grid over-frequency (f>) tripping time
Ⅱ-Max-F. grid	Stage Ⅱ Grid over-frequency (f>>)
Ⅱ-Max-F. time	Stage Ⅱ Grid over-frequency (f>>) tripping time
Min-F. prot	Under-frequency protection
Ⅰ-Min-F. grid	Stage Ⅰ Grid under-frequency (f<)
Ⅰ-Min -F. time	Stage Ⅰ Grid under-frequency (f<) tripping time
Ⅱ-Min -F. grid	Stage Ⅱ Grid under-frequency (f<<)
Ⅱ-Min -F. time	Stage Ⅱ Grid under-frequency (f<<) tripping time

Confirm settings by pressing **ENTER** and enter the "Setting confirmation" screen.
Check all above-mentioned parameter settings. Confirm them by pressing **ENTER**. Cancel by pressing **ESC** and reset.



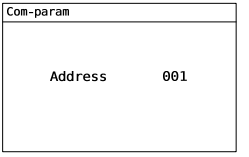
When the Country or the Grid code or LVRT switch mode is changed, the protective settings will be unavailable unless the inverter is re-energized.

10.12 Communication Parameters Setting

Main Screen(Press ENTER) →Menu screen(Press ▼ ×3) → Set-param (Press ENTER) →Enter password(Press ENTER, Press ▼×3) →Com-param (Press ENTER)

Press ➤ to move cursor right and **Press** ▼ to set the appropriate value. Confirm settings by Pressing **ENTER**.

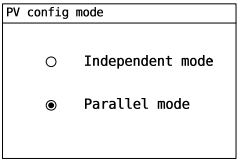
The range of communication address is 1...247.



10.13 PV Configuration Mode Setting

Main Screen(Press ENTER) →Menu screen(Press ▼ ×3) → Set-param (Press ENTER) →Enter password(Press ENTER, Press ▼×4) →PV config mode (Press ENTER) →Enter password(111111, Press ENTER)

On the "PV config mode" screen, Press ▼ to choose PV configuration mode, Press **ENTER** to confirm the settings.
PV configuration mode will be valid when the inverter is re-energized again by rotating DC switch to the "OFF" position and then to the "ON" position.
The default configuration mode is independent mode.



10.14 Special Settings for Italy

If the "Countries" selection is "IT" (Italy), several LCD menus and operation methods are different from other countries.

The differences focus on "Run-param" and "Pro-param" as shown below.

10.14.1 Over-frequency Derating Setting for Italy

If the "Countries" selection is "IT" (Italy), the "Derating Slope"* will display in the "Run-param" screen.

When the grid frequency is between 50.3Hz and 51.5Hz, inverter will decrease power according to the "Derating Slope".

Default derating slope (Pm/Hz, Pm is the power before derating): 83.33%. Range: 40% ...100%.

Note: "Derating Slope"* is the power derating slope. Power derating slope = 100 / (Grid frequency × Frequency derating slope). Frequency derating slope range: 2% ...5%.

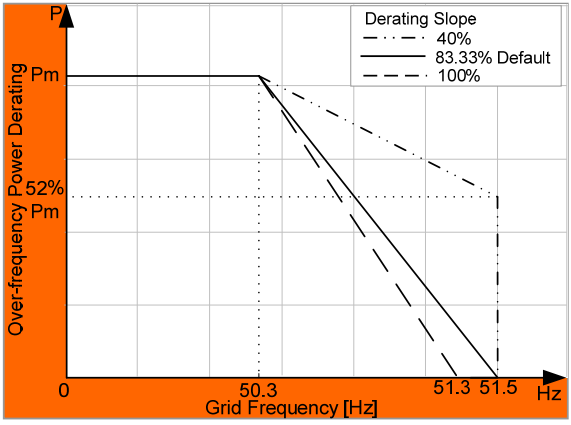


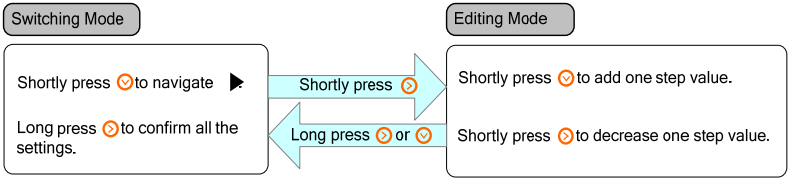
Fig. 10-5 "IT" Over-frequency Derating Curve

10.14.2 Reactive Power Regulation for Italy

Button Operation

The button functions for Italy parameter setting sub-menus may differ from that in other menus.

Proceed as follows to perform the parameter settings.


Switching Mode
Editing Mode
Shortly press to navigate
Long press to confirm all the settings.
Shortly press
Long press or
Shortly press to add one step value.
Shortly press to decrease one step value.

Italy "Q(P)" Mode

The power factor changes with the output power of the inverter.

Select Q(P) mode and **Press** ▼ to enter into the "Run-para-Q(P)" sub-menu.

Press ▼ to navigate the cursor; **Press** ➤ to enter into the editing mode, then the selected parameter will be shaded.

Press ▼ to increase one-step value; **Press** ➤ to decrease one-step value.

Press ENTER to confirm the setting and exit from the editing mode.

Run-param-Q(P)	P3/3
▶ PA	020.0%
PB	050.0%
PC	100.0%
Pf max	0.900
Uin	105.0%
Uout	100.0%

Tab. 10-9 Italy "*Q(P)*" Mode Parameters Explanation

Parameter	Explanation	Default	Range	Step
PA*	Active power at point A *(in %)*	20%	20%…100%	1%
PB*	Active power at point B *(in %)*	50%	20%…100%	1%
PC*	Active power at point C *(in %)*	100%	20%…100%	1%
Pf max	Power factor at point C	0.9	0.9…1	0.01
Uin**	Enter into the Q(P) regulation mode when the grid voltage is above Uin	105%	100%...110%	1%
Uout**	Exit from the Q(P) regulation mode when the grid voltage is below Uout	100%	90%...100%	1%

*PA < PB≤ PC ** Uin > Uout

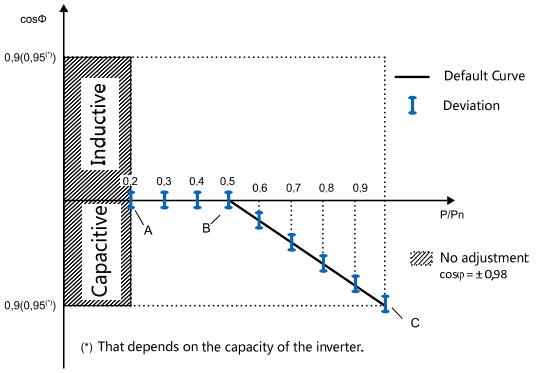


Fig. 10-6 Reactive Power Regulation Curve in "IT" Q(P) Mode

Italy "Q(U)" Mode

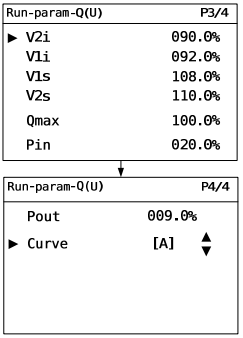
The reactive power ratio changes with the grid voltage.

Select Q(U) mode and **Press** ▼ to enter into the "Run-para-Q(U)" sub-menu.

Press ▼ to navigate the cursor; **Press** ▶ to enter into the editing mode, then the selected parameter will be shaded.

Press ▼ to increase one-step value; **Press** ▶ to decrease one-step value.

Press ENTER to confirm the setting and exit from the editing mode.



Tab. 10-10 Italy "*Q(U)*" Mode Parameters Explanation

Param.	Explanation	Default	Range	Step
V2i*	Grid voltage at point D (in %)	90%	90%...110%	1%
V1i*	Grid voltage at point C (in %)	92%	90%...110%	1%
V2s*	Grid voltage at point A (in %)	108%	90%...110%	1%
V1s*	Grid voltage at point B (in %)	110%	90%...110%	1%
Qmax	The max. ratio of reactive power (in %)	90%	50%...100%	1%
Pin**	Enter into the Q(U) regulation mode when the power is above Pin	20%	20%...100%	1%
Pout**	Exit from the Q(U) regulation mode when the power is below Pout	9%	1%...20%	1%
Curve	Curve type	A	A/B	-

*V2i < V1i < V1s < V2s **Pin > Pout

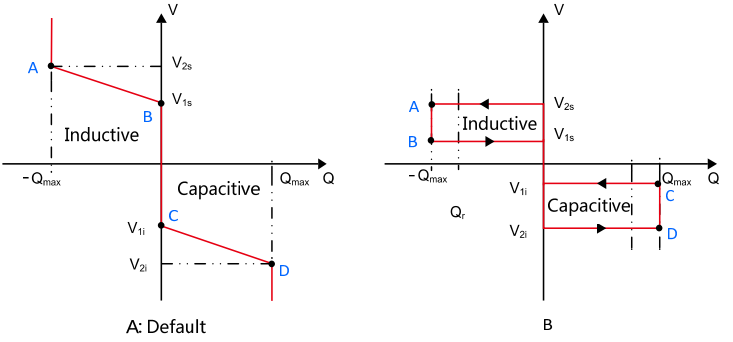


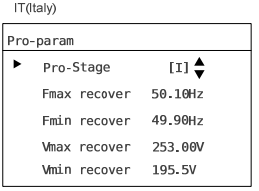
Fig. 10-7 Reactive Power Regulation Curve in "IT" Q(U) Mode

10.14.3 Protective Parameters Setting for Italy

If the "Countries" selection is "IT" (Italy), the protective parameters settings procedures are shown below.

After "Grid codes" selection, you may enter into the "Pro-param" sub-menu.

Press ▼ to select parameter, **Press** ➤ to move cursor right and **Press** ▼ to set the appropriate value. Confirm settings by **pressing ENTER**.

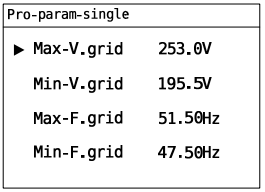


Tab. 10-11 Italy Grid protection Recovery Value

Parameter	Explanation
Fmax recover	Inverter can start operating only when the grid frequency is below Fmax recovery. The fault recovery value when the grid over-frequency occurs.
Fmin recover	Inverter can start operating only when the grid frequency is above Fmin recovery. The fault recovery value when the grid under-frequency occurs.
Vmax recover	Inverter can start operating only when the grid voltage is below Vmax recover. The fault recovery value when the grid over-voltage occurs.
Vmin recover	Inverter can start operating only when the grid voltage is above Vmin recover. The fault recovery value when the grid under-voltage occurs.

"IT" Stage Ⅰ Protective Parameter

If the selected protective parameter is "Pro-stage Ⅰ", the following sub-menu will come up.
Press ▼ to select parameter, **Press** ➤ to move cursor right and **Press** ▼ to set the appropriate value. Confirm settings by Pressing **ENTER**.

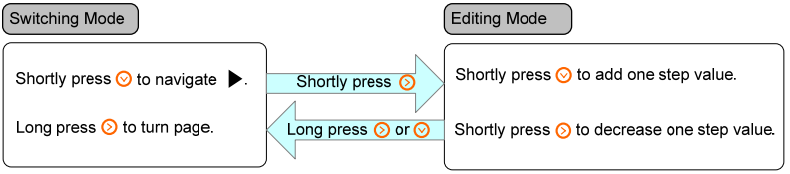


Tab. 10-12 Stage Ⅰ Protective Parameter Explanation

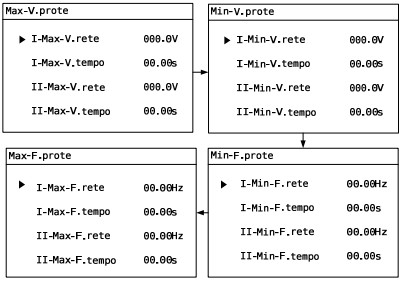
Parameter	Explanation	Parameter	Explanation
Max-V.grid	Grid over-voltage value	Max-Fgrid	Grid over frequency value
Min-V.grid	Grid under-voltage value	Min-F.grid	Grid under frequency value

"IT" Stage Ⅱ Protective Parameter

The button functions for Italy Stage Ⅱ parameter setting sub-menus may differ from that in other menus.
Proceed as follows to perform the parameter settings.


Switching Mode
Editing Mode
Shortly press to navigate ▶.
Long press to turn page.
Shortly press
Long press or
Shortly press to add one step value.
Shortly press to decrease one step value.

Select "Pro-stage Ⅱ" and **Press** ▼ to enter into the sub-menus.
Press ▼ to navigate the cursor; **Press** ➤ to enter into the editing mode, then the selected parameter will be shaded.
Press ▼ to increase one-step value; **Press** ➤ to decrease one-step value.
Press ENTER to confirm the setting and exit from the editing mode.



Tab. 10-13 "IT" Stage Ⅱ Protective Parameters Explanation

Parameter	Explanation
Max-V. prote	Over-voltage protection
Ⅰ-Max-V. rete	Stage Ⅰ Grid over-voltage (U>)
Ⅰ-Max-V. tempo	Stage Ⅰ Grid over-voltage (U>) tripping time
Ⅱ-Max-V. rete	Stage Ⅱ Grid over-voltage (U>>)
Ⅱ-Max-V. tempo	Stage Ⅱ Grid over-voltage (U>>) tripping time
Min-V. prote	Under-voltage protection
Ⅰ-Min-V. rete	Stage Ⅰ Grid under-voltage (U<)
Ⅰ-Min -V. tempo	Stage Ⅰ Grid under-voltage (U<) tripping time
Ⅱ-Min -V. rete	Stage Ⅱ Grid under–voltage (U<<)
Ⅱ-Min -V. tempo	Stage Ⅱ Grid under–voltage (U<<) tripping time
Max-F. prote	Over-frequency protection
Ⅰ-Max-F. rete	Stage Ⅰ Grid over-frequency (f>)
Ⅰ-Max-F. tempo	Stage Ⅰ Grid over-frequency (f>) tripping time
Ⅱ-Max-F. rete	Stage Ⅱ Grid over-frequency (f>>)
Ⅱ-Max-F. tempo	Stage Ⅱ Grid over-frequency (f>>) tripping time
Min-F. prote	Under-frequency protection
Ⅰ-Min-F. rete	Stage ⅠGrid under-frequency (f<)
Ⅰ-Min -F. tempo	Stage Ⅰ Grid under-frequency (f<) tripping time
Ⅱ-Min -F. rete	Stage Ⅱ Grid under-frequency (f<<)
Ⅱ-Min -F. tempo	Stage Ⅱ Grid under-frequency (f<<) tripping time

11 Appendix

11.1 Technical Data

Parameters	SG10KTL	SG12KTL	SG15KTL	SG20KTL
Input Side Data				
Max. PV input power(DC1/DC2)	10800W (5400W/ 5400W)	12800W (6400W/ 6400W)	15800W (7900W/ 7900W)	21000W (10500W/ 10500W)
Max. PV input voltage	1000V			
Startup voltage	270V	270V	270V	300V
Nominal input voltage	620V			
MPP voltage range	250…950V	250…950V	250…950V	280…950V
MPP voltage range for nominal power	250...800V	330...800V	380...800V	480...800V
No. of MPPTs	2			
Max. number of PV strings per MPPT (DC1/DC2)	3/3			
Max. PV input current (DC1/DC2)	40A (20A/20A)	40A (20A/20A)	40A (20A/20A)	42A (21A/21A)
Max. current for input connector	12A			
Short-circuit current of PV input (DC1/DC2)	50A (25A/25A)			
Output Side Data				
Nominal AC output power	10000W	12000W	15000W	20000W
Max. AC output apparent power	11100VA	13300VA	16700VA	22200VA
AC reactive Max. output current	15.2A	18.2A	22.7A	33A

Parameters	SG10KTL	SG12KTL	SG15KTL	SG20KTL
AC active Max. output current	14.4A	17.3A	21.7A	29A
Nominal AC voltage	3/N/PE, 230V/400V			
AC voltage range	310…480Vac (May vary as per corresponding country's grid standard)			
Nominal grid frequency	50Hz/60Hz			
Grid frequency range	47…53Hz/57…63Hz (May vary as per corresponding country's grid standard)			
THD	< 3 % (Nominal power)			
DC current injection	<0.5% In			
Power factor	>0.99 @default value at nominal power, (adj. 0.8 overexcited~0.8 underexcited)			
Protection				
Anti-islanding protection	Yes			
LVRT	Yes			
AC short circuit protection	Yes			
Leakage current protection	Yes			
DC switch	Integrated			
DC fuse	No			
Overvoltage protection	Varistors			
System				
Max. efficiency	98.0%			
Max. European efficiency	97.2%	97.2%	97.3%	97.3%
Isolation method	Transformerless			
Ingress protection rating	IP65			
Night power consumption	<1W			
Operating ambient temperature range	-25℃...60℃(> 45℃ derating)			
Allowable relative humidity range	0...100%			
Cooling method	Smart forced air cooling			
Max. operating altitude	4000m (> 3000m derating)			
Display	Graphic LCD			

Parameters	SG10KTL	SG12KTL	SG15KTL	SG20KTL
Communication	RS485 (RJ45 connector)			
Certification	EN62109-1, EN62109-2, EN61000-6-2 , EN61000-6-3, VDE0126-1-1, CEI-021, C10/C11, EN50160, RD1669, IEC61727, UTE C 15-712-1, EN50438, AS/NZS3100, AS4777.2, AS4777.3, G83/1(10K), G59/2(12K/15K), VDE-AR-N-4105, BDEW, CGC-Solar.			CE, DE0126-1-1, EN62109-1, EN62109-2, G59/2, CEI-021, AS/NZS 3100, AS4777.2, AS4777.3, VDE-AR-N-4105 , BDEW, CGC-Solar, Q/GDW 617.
Mechanical Data				
Dimensions (W×H×D)	648×686×246mm			
Mounting systerm	Wall bracket			
Weight	50kg	50kg	50kg	55kg

11.2 Terminals and Cables

Terminal		Type	Conductor size	Recommended conductor size
AC terminal	SG10KTL	Amphenol C16_L	11AWG…8AWG 4…8.37	11AWG 4mm^2
	SG12KTL			11AWG 4mm^2
	SG15KTL			9AWG 6mm^2
	SG20KTL	Wieland RST50I5	10AWG…8AWG 6…8.37	8AWG 8.37mm^2
DC terminals		MC4 PV-KST4/6II-UR PV-KBT4/6II-UR	12AWG…10AWG 4…6mm^2	11AWG 4mm^2
RS485 Comm. terminals		RJ45	Twist-pair type shielding Ethernet cable	
Second PE terminal		-	10AWG…8AWG 6mm^2	9AWG 6mm^2

11.3 Exclusion of Liability

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11.4 About Us

Sungrow power supply is a China-leading manufacturer of various power electronics products for renewable energy generation systems. Our products include converters, inverters, battery chargers and other power supplies for distributable generation system in both grid-connected and stand-alone applications. The power rating of Sungrow products covers from hundred watt to mega-watt systems.

The vision of Sungrow is to help our customers acquire stable and clean power with minimum cost, maximum reliability and enhanced safety.

Contact Information

Should you have any problems about this product, please contact us through the following information. We will be more than happy to assist you!

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